Design News

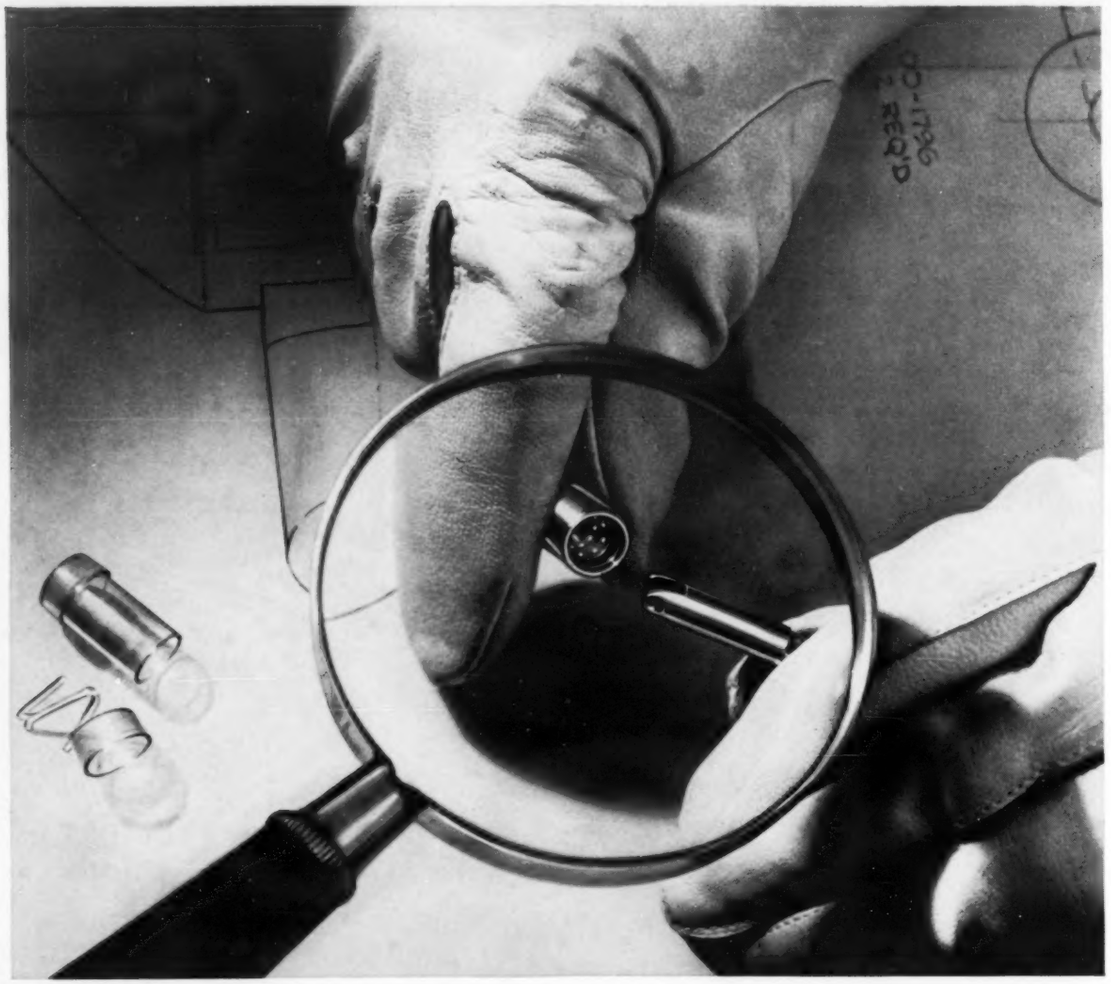


Air data computer permits choice of gear trains. P. 8

A CAHNERS PUBLICATION

JUNE 19, 1961

NEW DEPARTURES IN MINIATURE



HOW TO GIVE ON-THE-NOSE GUIDANCE TO MODERN "FISH"

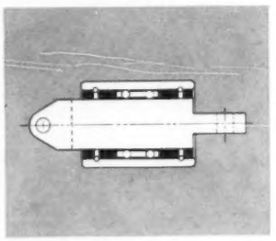
UNIQUE N/D LINEAR MOTION BEARING FREES GYRO CAGING ACTION

The bearing illustrated is an N/D linear motion precision instrument ball bearing. It was specially designed and built to help solve a critical problem in the guidance system of a high speed anti-submarine torpedo.

PROBLEM: Loss of accuracy in torpedo's guidance system due to hang-up of caging arm in gyro assembly.

SOLUTION: N/D Sales Engineer, in cooperation with manufacturer, found that *wear* of bushing on caging arm caused hang-up, delaying guidance activation. N/D Engineers set to work to design and build an instrument bearing that operates virtually friction-free. The result: Preservation of the guidance system's pin-point accuracy and reliability.

Should you require ball bearing design information, invite the local N/D Sales Engineer to participate in your early design discussions. He represents one of the industry's largest engineering staffs devoted exclusively to the design and development of miniature and instrument ball bearings. Or, write for new Miniature and Instrument Ball Bearing Catalog, Department L.S., New Departure, Division of General Motors Corporation, Bristol, Connecticut.



This special N/D linear motion instrument ball bearing increased guidance reliability of ASTOR torpedo weapon system developed by Westinghouse.

NEW DEPARTURE
MINIATURE AND INSTRUMENT BALL BEARINGS

Circle 1 on Reader-Service Card for more information

NBP June 19, 1961 Vol. 16 No. 13 BPA

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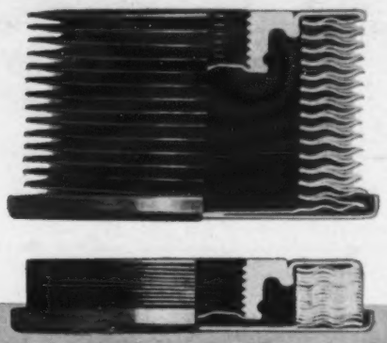
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SOUNDING BOARD

FOR OUR READERS



Engineer in a Cocoon

Referring to your editorial in the April 24 DESIGN NEWS, I must take issue with Nelvin Palley and John Dubois.

In most companies, the "peons at the drafting boards", as he calls them, are the ones who carry the so-called college-bred engineers. There are very few of these so-called engineers capable of any serious design.

If management really wants creative engineers with drive and designing knowledge, which is more important than professional attitude, each member of management also must sit at a board. Not for a day, or a month, but for a period of years.

He now becomes a "peon" and he certainly doesn't have a professional attitude, but he's getting closer to it all the time. Eventually, he can say to himself, "I can lick almost any type of engineering design problem they might throw at me."

Now and only now can he assume an air of professionalism. And only because he has earned it. Not because a college gave him a piece of paper that said, "This is an engineer."

NICHOLAS C. LUTZ
The Singer Mfg. Co.
Elizabeth, N. J.

Hurrah for your editorial, "Engineer in a Cocoon", appearing in the April 24 issue.

MILTON HOLBREID
Morristown, N. J.

Federal Aid

Your proposal for federal aid to education in a very nominal way as written up in January 30 DESIGN NEWS was certainly in the right direction, at least insofar as I am concerned. . . .

In addition to your three proposals, it seems to me there is also a great opportunity to add to our educational program in the local community with facilities which already exist by using them in the evening for upgrading or retraining with the details to be worked out according to community requirements. This kind of a program, of course, requires that the communities take the lead in the solution of the problem rather than leaving it to the federal government. . . .

H. A. BREEDING
Hendersonville, N. C.

A. H. Shairman, (Sounding Board, Apr. 24, '61) thoughtfully provided readers with the very reasons why federal aid to education proposals are ill-conceived and destructive to the principles of individual freedom and responsibility established within our Constitution. . . .

I deplore the implication that federal aid, or education, itself, for that matter, is necessary to "improve the utilization of our human resources". Our republic was founded to prevent its citizens from being "utilized" by a higher authority and to prevent them from becoming mere "resources" much as iron ore and coal. The function of our schools is not to elevate society, but rather to educate individuals and to equip them with the knowledge that will enable them to take care of society's needs. . . .

This nation did not achieve its position of world leadership by federal doles, reducing its 180 million individual citizens to "human resources", judging itself by world opinion, providing its citizens with psychotherapy and educating its incompetents at the expense of its able. But just as surely as it sets about to do these, it will relinquish its position.

FREDERICK J. MILLER
China Lake, Calif.

More on Spare Parts

Many technical people in the government, both in the military services and civilian employees, have been and are as concerned with the problems of specifications, inspection procedures and techniques as any of the industries with which we deal. The problem is extremely complex, both technically and legally, but it seems hardly likely that it will be solved by such intemperate charges as "the majority of government employees . . . will by their very nature seldom do an honest and competent day's work for their pay."

After more than 20 years of engineering experience in both civilian industry and the military establishment, I cannot agree that government employees are any different from those in industry—with the possible exception that they are more devoted to the job than to the paycheck. . . .

REX H. WHITE, JR.
Colonel, Ord. Corps
Director, Res. & Engr.
Ord. Tank-Automotive Command
Detroit, Mich.

Decline and Fall

Since the dawn of civilization, countries have clawed their way to the top, remained at pinnacle for some indeterminate time, declined and then finally fell. The Assyrians, the Hebrews, the Persians, the Egyptians, the Greeks, the Romans all followed this pattern.

Has the United States also passed its pinnacle?

One sure sign of the decline of a country or a civilization is the decline in the moral and physical fiber of its people. We have seen a number of such signs since World War II.

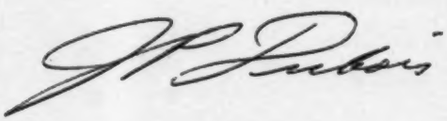
The Senate Investigation Sub-Committee, more familiarly known as the McClellan Committee, is currently listening to some very disturbing facts. We have read about testimony from key personages in our space effort about some 327 work stoppages at missile bases since 1956. We have read about workers insisting on being paid for standing around doing nothing. We have read of people drawing quadruple time through previous arrangements for work schedules. We have heard of intentional slowdowns in order to gain overtime hours. On the other side we have been told about padded contracts, collusion between manufacturers and similar wastes.

Regardless of who is at fault in the mess being uncovered by the McClellan Committee, these are symptoms of moral decay. The mere fact that so many people smile and look the other way when they see cheating of any kind is a national disgrace.

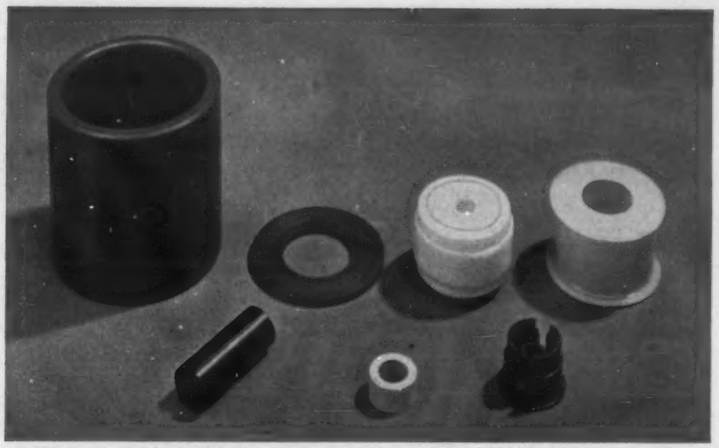
Have we grown so fat and so lazy that moral values no longer have a meaning? If so, we might as well wait for the end. For unless we decide that we are willing to fight for our way of life it is only a question of time before another, more youthful ideology from overseas sinks us as promised.

It is not a question of how many missiles we have or how many universities we have or how much we pay our workers. The question, pure and simple, is one of moral fiber.

Do we have strong enough beliefs in what is right—or are we witnessing the decline and fall of the United States?



Executive Editor



METAL BEARINGS OR PLASTIC?

How do you decide?

Polymer is ready to help.

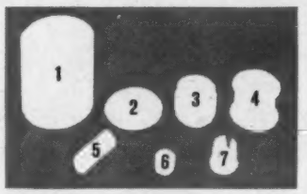
The above bearings are made of POLYPENCO industrial plastics. Their individual and unique bearing characteristics make them better than metal for many applications . . . with lower costs and improved performance.

In mechanical areas previously dominated by metals, engineers have found POLYPENCO bearing materials can perform better, wear longer (with or without lubrication) and materially reduce maintenance and replacement.

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2. POLYPENCO K-51 PENTON* A chlorinated polyether with outstanding chemical resistance and high strength. Especially well suited for chemical applications that require better mechanical properties than TFE.

3. POLYPENCO TFE-FLUOROCARBON Possesses a very low coefficient of friction. Will not exhibit "slip-stick" and high starting torque is not required. Unique as a bearing material for lightly loaded applications.

4. POLYPENCO 101 NYLON A widely used plastic bearing material. Has good mechanical strength, chemical resistance and frictional properties. Easily machinable.

5. NYLASINT® NYLON PARTS Parts formed by cold pressing and sintering nylon powder. Are impregnated with oil and alloyed with fillers to provide premium wear resistance and outstanding dimensional stability.

6. FLUOROSINT® TFE COMPOSITION A TFE base material which has excellent mechanical stability up to 500°F. Exhibits superior wear resistance while maintaining the electrical and chemical resistance of unmodified TFE-fluorocarbon.

7. NYLATRON® GS NYLON A molybdenum disulphide-filled nylon formulated with premium bearing properties. The moly-sulphide filler provides a low coefficient of friction and excellent abrasion resistance.

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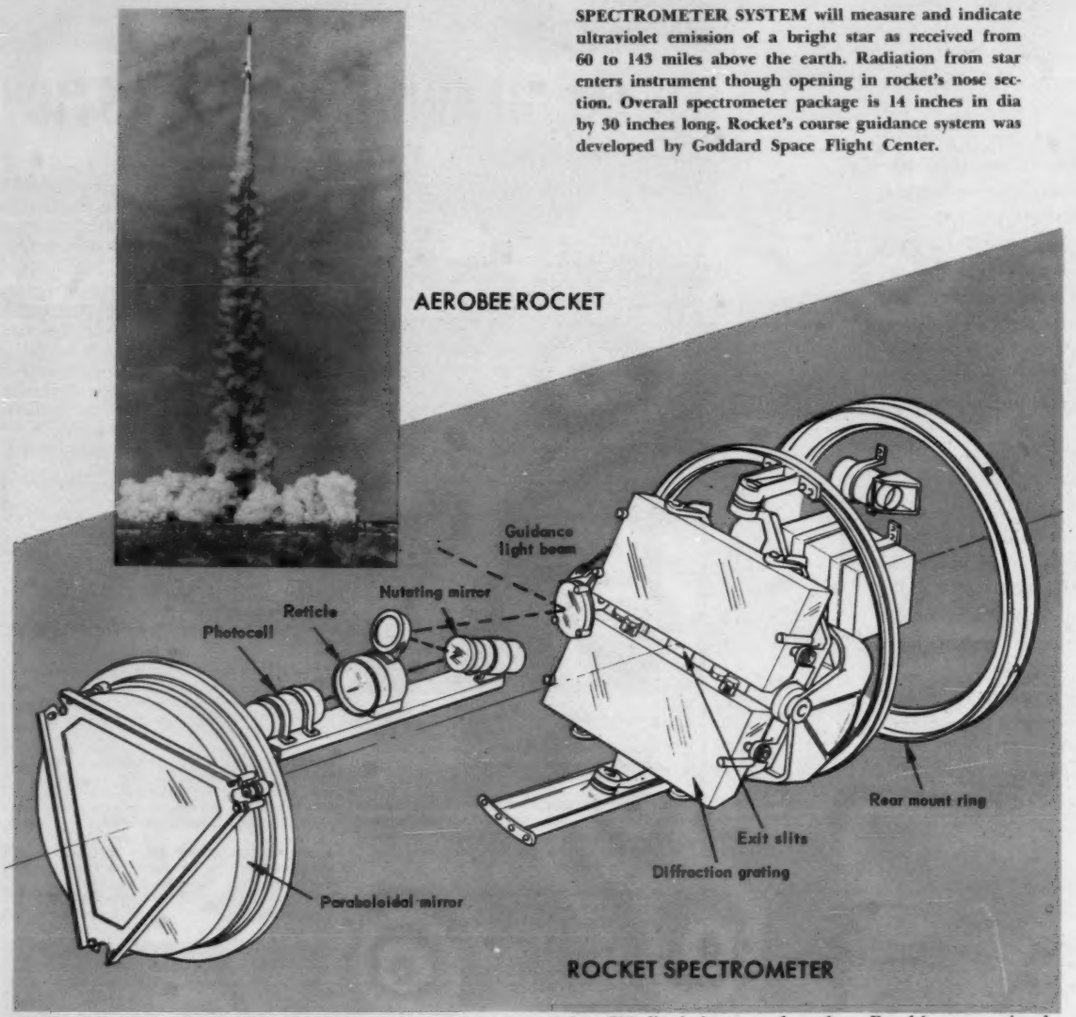
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Rocket's Spectrometer Doubles as Fine Guidance Control

Victor W. Wigotsky, Eastern Editor



SPECTROMETER SYSTEM will measure and indicate ultraviolet emission of a bright star as received from 60 to 143 miles above the earth. Radiation from star enters instrument though opening in rocket's nose section. Overall spectrometer package is 14 inches in dia by 30 inches long. Rocket's course guidance system was developed by Goddard Space Flight Center.

TWO-AXIS FINE GUIDANCE SYSTEM uses simple "rotating image" method. Spectrometer's stabilized diffraction grating is positioned precisely by servos which adjust two axes of gimbal ring-mount. Light beam from star impinges on rotating tilted mirror and then is directed through reticle. Latter is segmented into "sunburst" pattern which modulates beam according to amount and direction of error. Modulated beam is then focused on phototube whose signal is amplified and fed to FM discriminator and resolver. Resulting error signal controls servos which adjust gimbals. Entire surface of grating acts as reflecting surface for paraboloidal mirror. Mirror focuses parallel rays for passage through two exit slits to independent detectors. One detector is sensitive to first-order wavelengths from the grating (2000 to 3000 Angstrom units) and the other sensitive to second-order wavelengths (1000 to 1500 Angstrom units).

NORWALK, CONN.—A rocket-borne spectrometer system will use the light beam from a star for fine guidance as well as for analysis of ultraviolet radiation. The light beam will function as an input to hold the instrument's diffraction grating on target.

The spectrometer will be carried aloft in an Aerobee rocket, since opacity of the atmosphere prevents earth-based studies of stellar radiation. The rocket itself is guided to within ± 1 deg by an inertial gyro system. The spectrometer's fine guidance system then positions the instrument to within ± 6 sec of arc, over a ± 2-deg field.

The guidance light beam is deflected to the surface of a nutating mirror, which produces a circular motion of the star image on a reticle. A constant-frequency output from a photocell results when the light pattern is centered on the reticle. However, the photocell output is frequency-modulated if the light beam from the star becomes off-centered during the nutation. The photocell signal is then amplified and fed to an FM discriminator which provides a servo error signal to drive the diffraction grating in two axes. This assures that the light impinging on the grating will be properly focused for passage to detectors which measure the ultraviolet radiation.

The spectrometer and its fine guidance system were designed by the Perkin-Elmer Corp. under a contract with the Princeton University Observatory. The rocket probe study program is supported by the National Aeronautic and Space Administration.

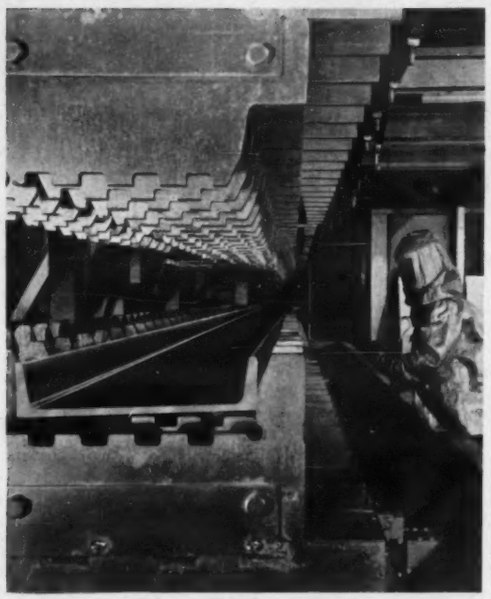
Rolled Structural Shapes Available in Alloy Steels

E. J. Stefanides, Central States Editor

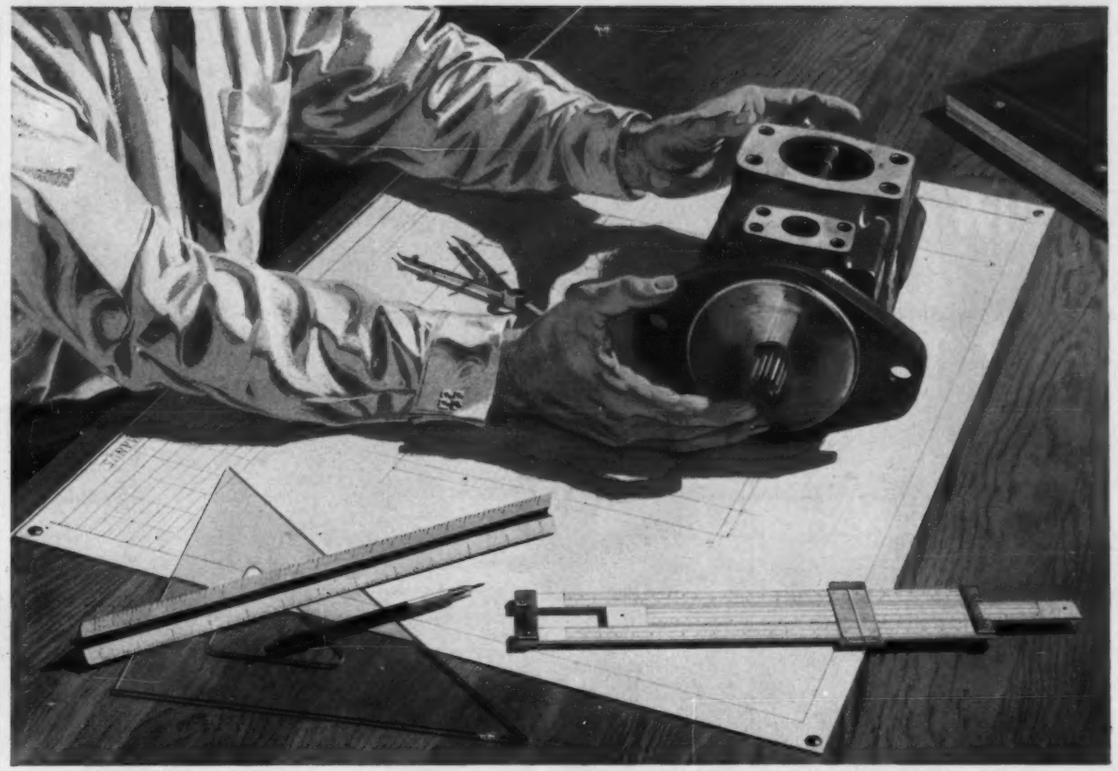
PITTSBURGH, PA.—Standard rolled structural shapes are being produced commercially in quenched and tempered alloy steels. These sections developed and now in production by the United States Steel Corp. include I-beams, channels and angles in lengths up to 40 ft. They are being made in T-1, T-1 type A, 9 percent Nickel Steel and HY-80 Naval Armor Steel. It is estimated that use of the new standard rolled shapes will save approximately 30 percent of the former cost of fabricated sections.

A suitable process and equipment for quenching and tempering of these structural shapes has been important in their development. The heat-treating-quenching process is in a large part responsible for the higher strength (up to three times that of conventional structural steel) and superior toughness.



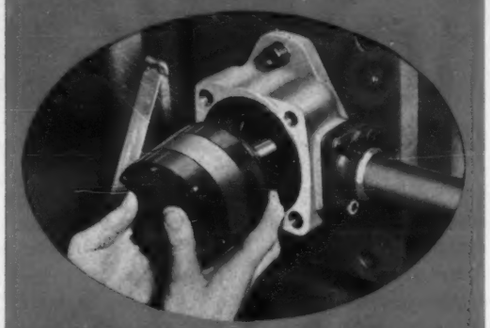


SPECIAL FIXTURE clamps alloy-steel structural shapes to prevent distortion during rapid cooling cycle. Waffle-like segments of upper and lower fixtures permit full flow for uniform quenching.



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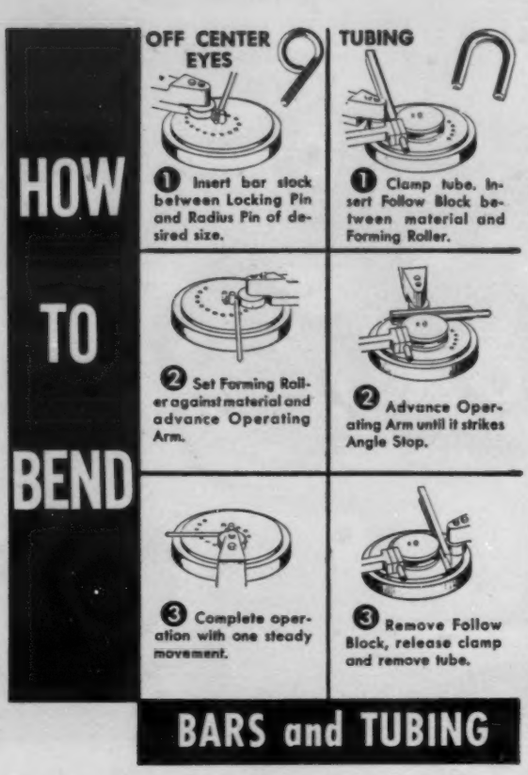
Additional data on pumps for mobile applications is available from your Vickers application engineer or by writing to address below. Ask for Bulletin P1.

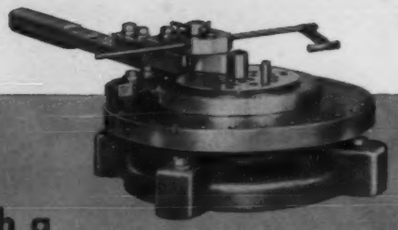
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SEEN AND HEARD

E. J. Stefanides, Central States Editor

THE BATTLE OF BUMPER HILL

is what one wag called it. Actually, the affair was quite serious, the start of a major publicity-advertising campaign initiated by the Great Lakes Steel Co., a major supplier of steel for the auto industry. Its object: to protect their market against possible inroads by a light-metal competitor. The stakes: 250,000 tons of bumper steel for 6,000,000 cars annually, a $40,000,000 per year market.





Round one. A Detroit press conference got off with a bang, or more precisely a blast from a 12-gage shotgun. The shotgun blast was one of a number of steel-versus-aluminum bumper test demonstrations. Its purpose was to demonstrate the relative resistance of steel and aluminum to denting and abrasion from flying road gravels. Other equally dramatic demonstrations included cooking and dunking in commercial car-wash solutions and same rather rugged car-jacking and collision tests. The object was to prove the superiority of the steel bumper.

Results of these tests and the enumeration of the comparative physical properties of the two metals by technical personnel were most gratifying for the Great Lakes Steel Co. They presented a very strong case for the steel bumper. Only one question remained to be answered.

THE MYSTERIOUS ALUMINUM BUMPERS

Where had they come from? When asked this question by a member of the press, the spokesman for Great Lakes gave a somewhat evasive answer. An answer which somehow hinted at clandestine, cloak-and-dagger procurement activities within the enemy camp.

Further discussion revealed that there were no competitive aluminum bumpers in production, that the conference itself was in effect a preventive measure—a measure initiated to combat the alleged promotional activities of one of its competi-



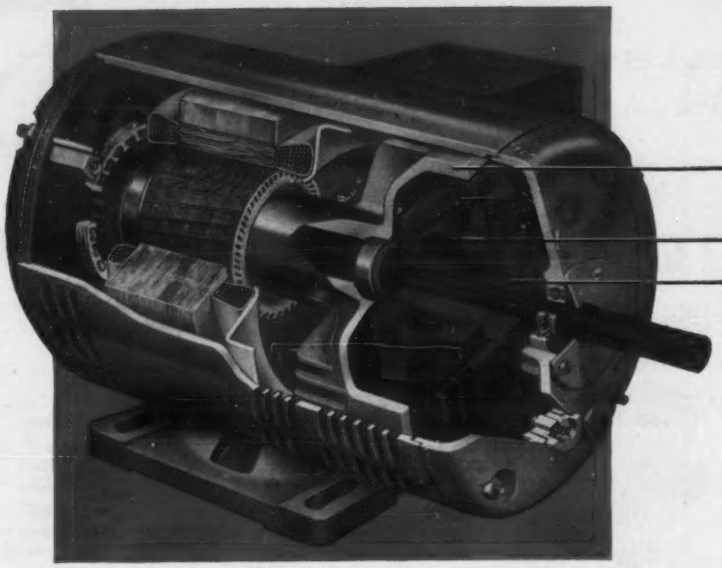
tors, that was, in the words of Great Lakes, "promoting a product which does not exist, and which probably never will exist".

THE ALUMINUM INDUSTRY

was, of course, not invited to the conference. The industry has, however, not ignored it. Engineers of the Aluminum Co. of America, who incidentally *were not* the alleged promoters of the competitive bumper, issued a statement from which the following excerpts are taken: "ALCOA has no intention of engaging in a controversy over the comparative merits of various materials for automotive parts. It suffices to say that all advances in the use of aluminum in automobiles . . . are the result of inherent qualities of the metal itself . . . if aluminum bumpers do become a standard item on a mass-produced American car, it will happen because, as in the past, the metal will win acceptance on a competitive, business-like basis . . . not as a consequence of unproved claims or derogatory comparisons with other materials."

OTHER ALUMINUM COMPANIES

may have issued similar statements. However, I have not seen them to date. I did see an aluminum bumper on display at the Design Show but was unable to determine if it was the brand X bumper—not having my shotgun handy!



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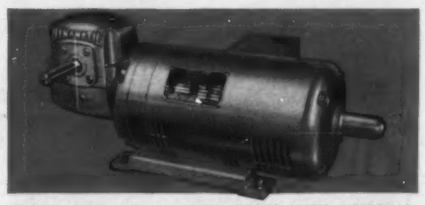
The Dynamatic Ajusto-Spede Drive is an integral combination of AC constant speed induction motor, eddy-current coupling, and plug-in type single-tube electronic control. Torque developed in the motor is transmitted to the driven member by electro-magnetic attraction; there is no mechanical contact between the driving and driven members.

Dynamatic Ajusto-Spede Drives operate on standard 115/230 volt, single phase, 60 cycle or 220/440 volt, 3 phase, 60 cycle alternating current—no special power source is required. Sizes are ¼, ½, and ¾ horsepower at 1600 RPM; ½, ¾, and 1 horsepower at 3200 RPM.

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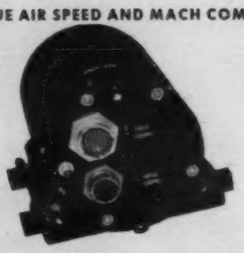
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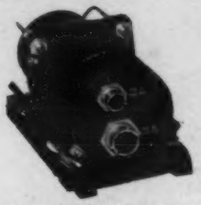


Fixed Gear Centers Give Design Flexibility in Air Data Computer

Edward W. Schrader, Western Editor

TRUE AIR SPEED AND MACH COMPUTER



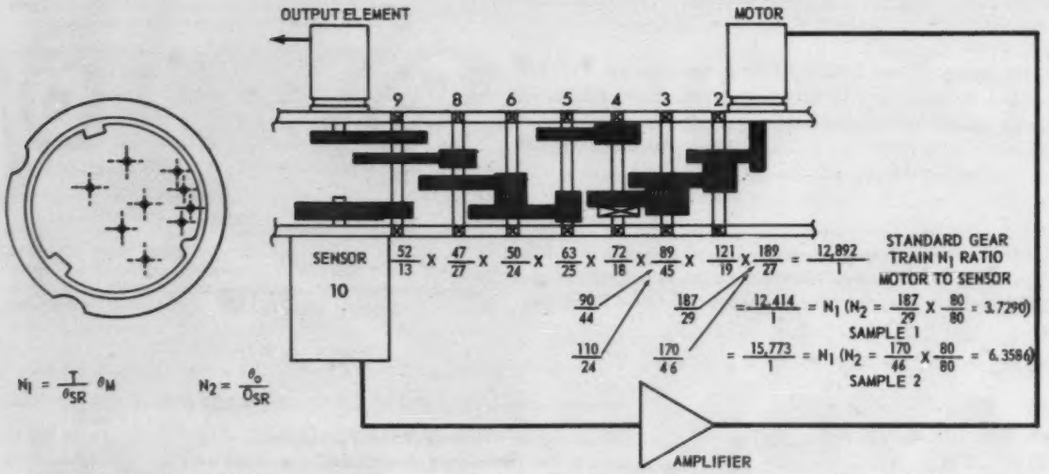


BASIC MACH COMPUTER

COMPARISON of basic transducer and its combination with complementary mach and true airspeed computer. Altitude transducer has a range of — 1000 ft to + 55,000 ft with accuracy of ±15 ft plus 0.2 percent of attained altitude. Mach computer has range of 0.1 to 1.0 mach with accuracy of ±0.001 mach in range of 125 to 450 knots. True airspeed computation has range of 70 knots to 450 knots with accuracy of ±2 knots above 125 knots.

SAMPLE DATA CHART

SAMPLE NO.	MACH RANGE	T SLEW TIME	θ_o OUTPUT SYNCHRO RANGE	θ_{SR} SENSOR RANGE	θ_M MOTOR SLEW SPEED	N_1 MOTOR SENSOR GEAR RATIO	N_2 SENSOR OUTPUT GEAR RATIO
	MACH NO.	SEC	DEG	DEG	DEG/SEC		
1	0.1 to 3.0	40	300	80.45	25,000	12,414	3.7290
2	0.5 to 1.5	30	300	47.18	25,000	15,773	6.3586



SAMPLE COMPUTATION of gear train illustrates solution of two completely different applications by changing two gear passes in standard gear train. In each case, amplified error signal from sensor causes motor to drive train until error signal is nulled in sensor. Mach numbers computed for output are different.

A good design philosophy must include design flexibility. Many sophisticated servomechanisms fail to include this latter ingredient. Though fixed center distances for gear trains are not new, they are often omitted as a design tool.

In this air data computer, the basic force-balance pressure transducer expands in function with gear changes, thus satisfying more sophisticated computation requirements. This use of fixed gear centers offers design flexibility through choice of gear ratios and through gear arrangements for additional output elements.

The initial computer ingredient is the basic pressure sensor. It provides a force-balance computation. By changing gear ratios in the servo, the mach range computed is varied. By changing capsules, springs and pressure connections in the sensor, computation is changed to pressure altitude, pressure ratio of dynamic pressure.

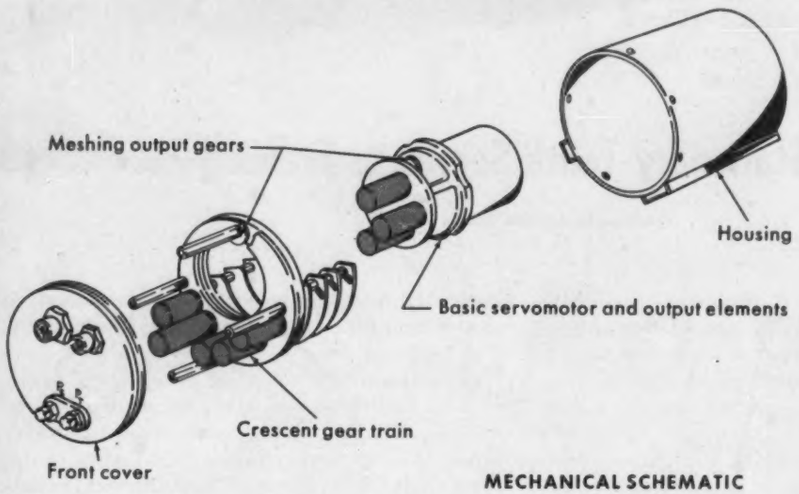
There are provisions for either a half-moon or full-moon transistorized amplifier, with a self-contained power supply. The half-moon amplifier is used where output devices and motor are located on one-half of the available gear plate space.

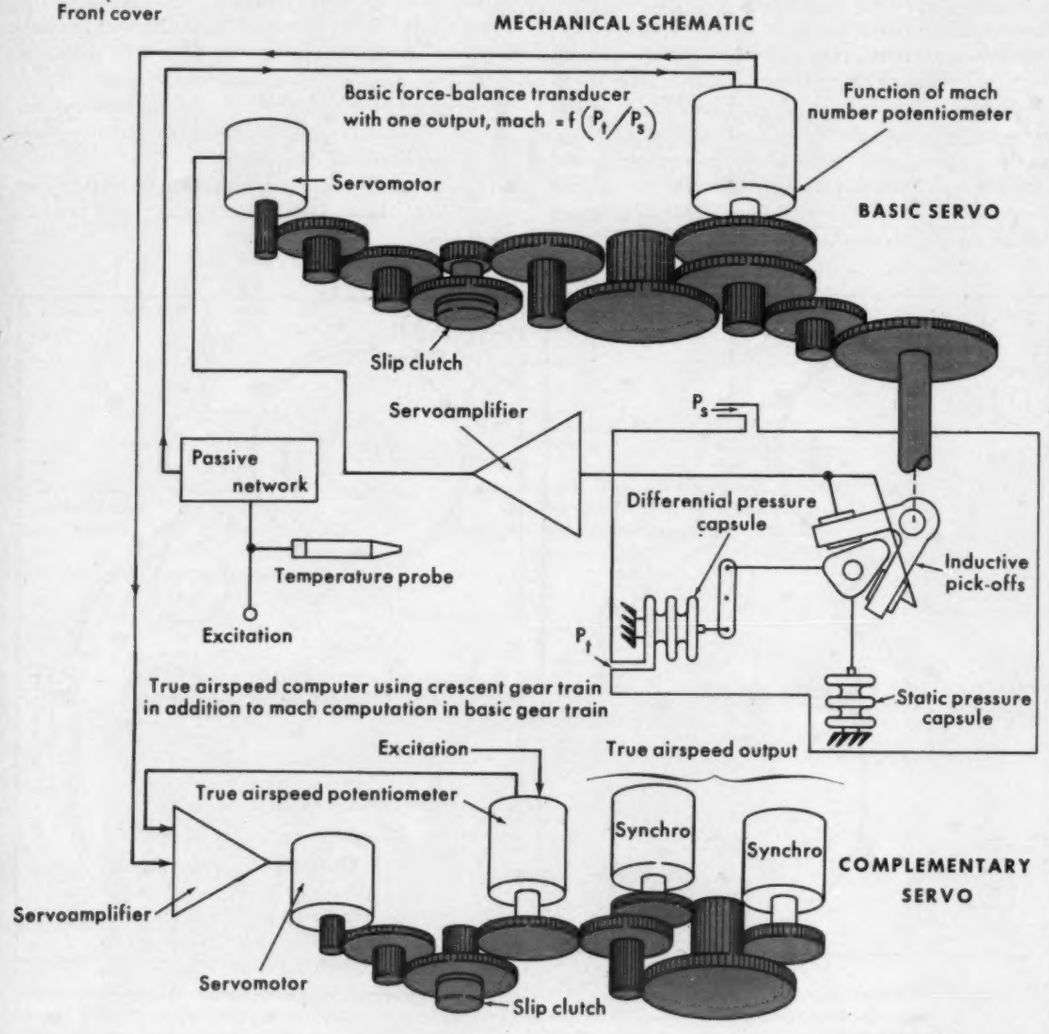
Where more output devices are required, a full-moon amplifier leaves the entire gear plate space available for outputs. By varying the gear ratios in the train, a full-scale mach rotational range of 1 or 3 is achieved.

A complementary servo extends the capabilities of the basic unit. Crescent-shaped gear plates, which partially surround the basic servo, add to the design flexibility, supplying more altitude or mach outputs than can be provided on the basic gear train. A high-speed gear in the basic transducer meshes with a gear in the crescent servo, duplicating the shaft position directly. This avoids repeating the calculation.

The crescent gear train also may be used as a second servomechanism to compute true airspeed, ($TAS = KMY^{1/2}$). This arrangement uses the mach computation of the first or basic servo, and by including a temperature probe input, the complementary servo gives true airspeed output.

The air data computer, utilizing this design philosophy is a development of Servomechanisms Inc., El Segundo, Calif.





AIR DATA COMPUTER expands outputs in either or both of two ways: first, additional outputs may be added to standard gear train located between sensor and output elements; second, by complementary gear train in crescent shape. Amplifier is packaged in either half-moon or full-moon shape on basic computer or in crescent shape around sensor.

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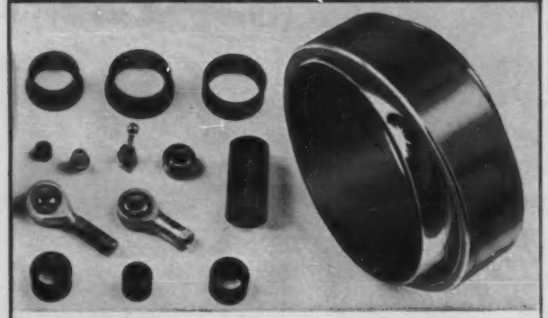
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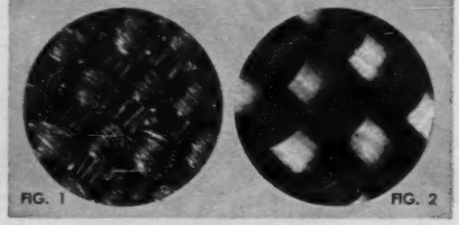


FIG. 1 FIG. 2

10X-STRENGTH PROVIDES MAXIMUM LIFE FOR LOW-SPEED, HIGH-LOAD APPLICATIONS

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Stationary Tooth Serves as Framing Mechanism

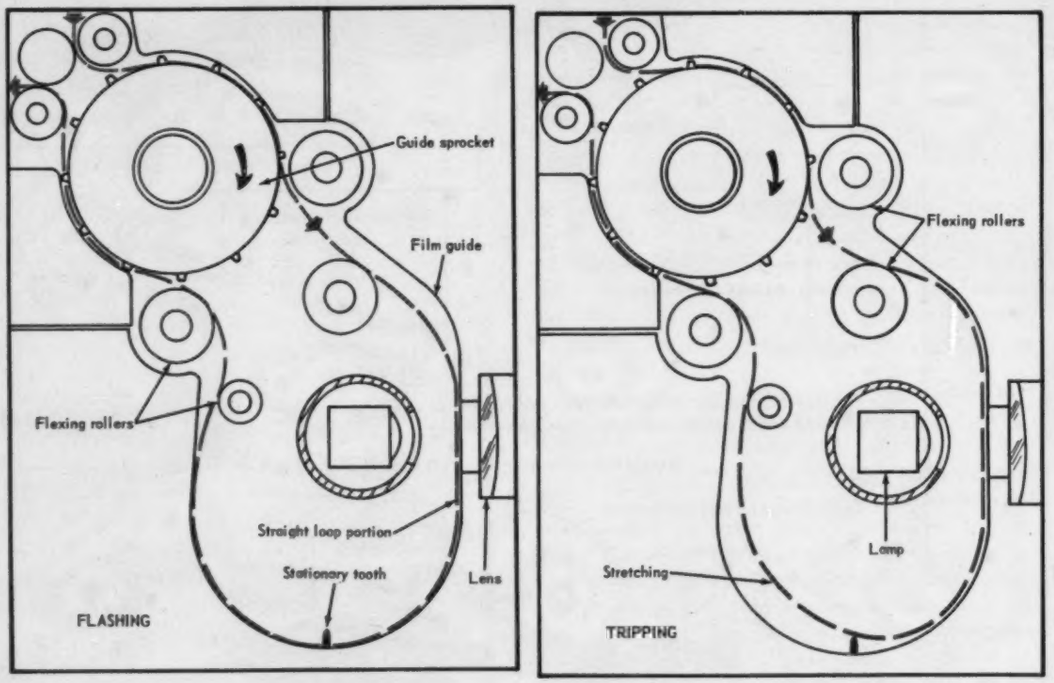
Celestino O. Lubatti, Italian Editor

A stop tooth in the special loop-shaped film guide of a motion-picture projector permits intermittent film advance without maltese cross or other ratcheting mechanisms. High-speed tripping of the film loop after each frame obviates the need for a shutter, permits use of a low-power lamp.

A guide sprocket rotated by the pull-out loop branch feeds film at constant speed. Flexing rollers control loop contraction and expansion to prevent incorrect stepping or jamming. The stationary tooth stops film for a short interval (flashing) while the sprocket lengthens the incoming branch and stretches the outgoing one. As the film steps over the tooth, the outgoing branch springs back to take the neutral shape imposed by flexing rollers. The lengthened incoming branch expands by one frame, thereby engaging the next sprocket hole with the stationary tooth. Combination of these two forces develops very high tripping speed.

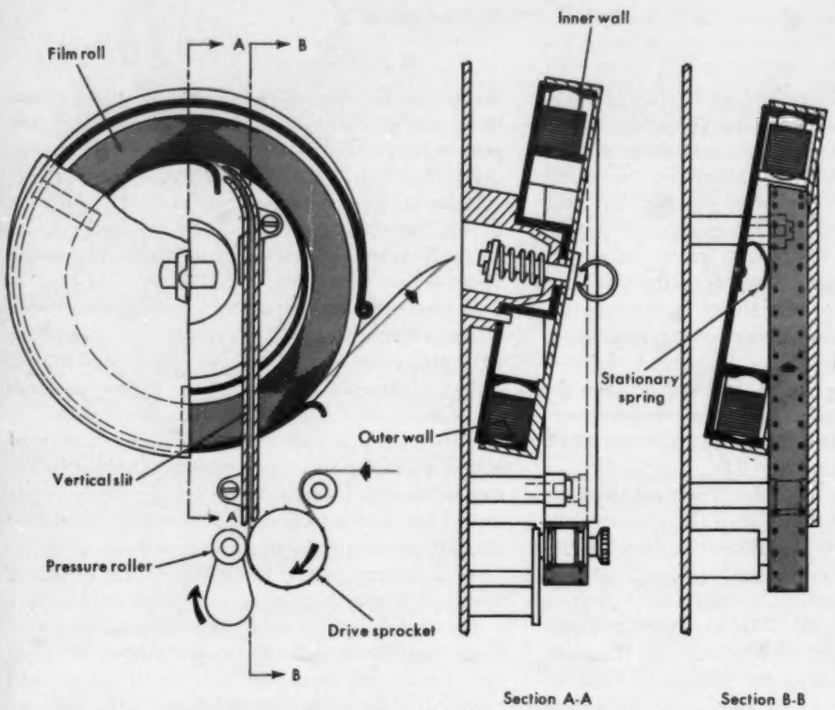
Inclined cartridge avoids use of separate rotating reels for feeding and rewinding the endless film. A drive sprocket, the only one for the whole film drive, thrusts film into a vertical guide slit leading to the inner circle of the cartridge. The film roll is semi-loose to allow relative motion caused by different rotational speed of inner and outer layers. Equal linear speed of winding and dispensing branches develops opposite radial forces which balance each other and limit film loosening.

The stationary spool, a design by M. Ferrario of Soc. Ascot, Milan, Italy, reduces space and production costs.

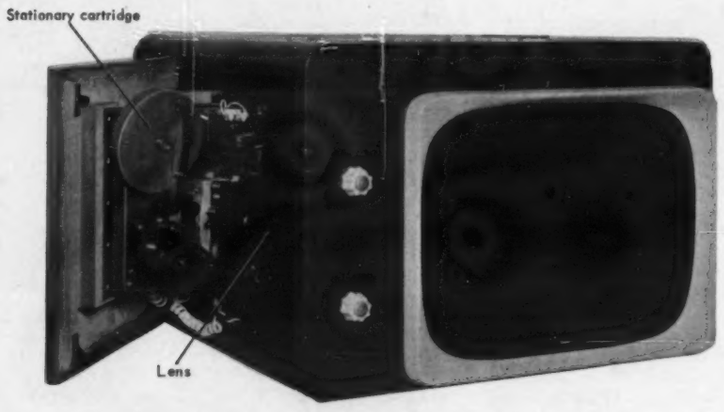


INCOMING BRANCH is curved by flexing rollers to keep straight portion of film loop against guide wall. This flexure prevents projected frame from running out of focus, allows lengthening of incoming branch during flashing interval. Outgoing branch flexure causes film to spring back (color line) as it becomes sufficiently stretched to step over stop tooth (black line). This action reduces sliding friction of film over guide wall to quicken tripping. Short tripping interval allows use of low-power lamp. This, in turn, permits projection of one frame for several minutes without overheating film. Two stop teeth are used when film is perforated on both sides.

in Endless-Film Projector



SEMILOOSE FILM ROLL lies eccentrically on inner and outer walls of stationary cartridge. Since winding and dispensing branches are wound and unwound on different diameters, film layers slide over one another with different rotational speeds. Constant-speed drive sprocket holds constant linear speed. Spring-loaded pressure roller insures film engagement with drive sprocket. Stationary spring keeps film within guide slit.



EXPERIMENTAL MODEL uses metal cartridge for 30 m (98 ft) film. Plastic cartridges are scheduled for production.

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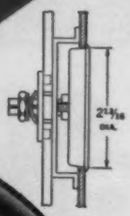


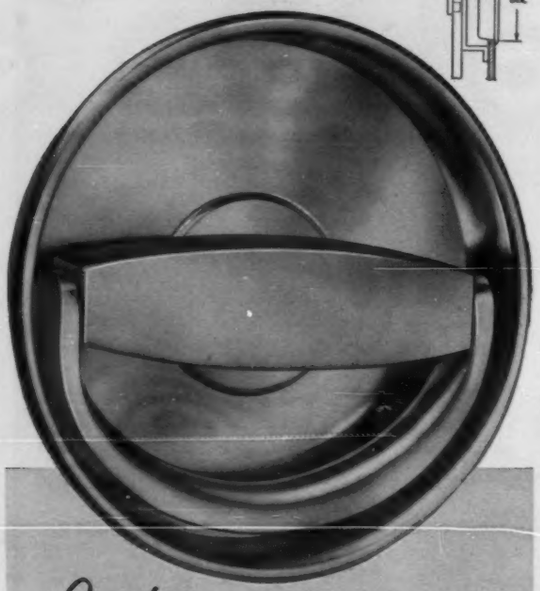
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Positioner's Variable-Rate Springs

E. J. Stefanides, Central States Editor

A variable-rate-range spring is used in conjunction with reversible pilot valve and nozzle parts in the design of a pneumatic positioner to provide a basic device capable of numerous variations. Use of the variable-rate spring arrangement provides combinations of five standard S.A.M.A. input pressure spans and travels ranging from ¼ to 8 inches, using only four basic-range springs. Change of spring rate is accomplished by varying the number of active spring coils through a sliding, upper spring clip which threads along the coils.

In the device, the spring is stretched between the output piston and a stationary, flexure-mounted bellcrank, and provides the feedback force which indicates piston position.

This feedback force is balanced against the force developed on the input instrument pressure diaphragm, whose force is transmitted to the other leg of the bellcrank through a yoke.

In operation, a change in instrument pressure disturbs the balance of forces on the bellcrank, causing the yoke to move in the direction of the lesser force. As it moves, a pin on the yoke changes the position of a ball valve in the pilot-valve diaphragm chamber nozzle. This initiates the proper action to restore the yoke to its null position.

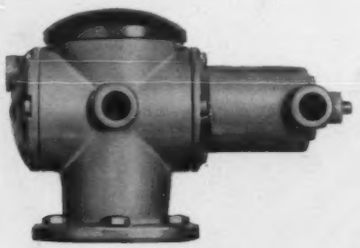
In addition, the pilot valve position and nozzle action can be reversed to convert the device from direct acting to reverse acting. For direct action, the pilot valve and nozzle are assembled so that increasing pressure on the input diaphragm causes an increasing output pressure. This causes the bellcrank to lift the range-tension spring, requiring an increase in output piston travel to restore the system to the original position.

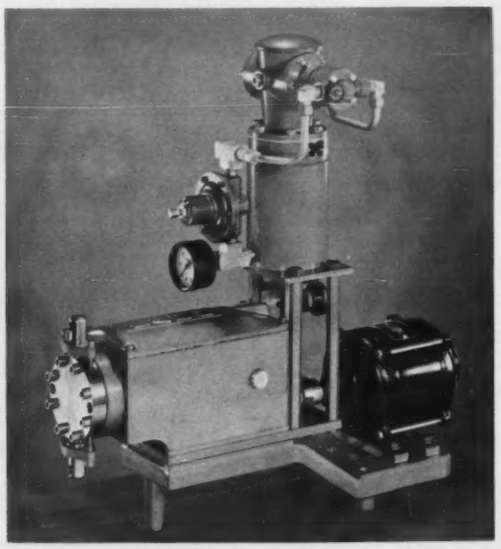
In reverse action, increasing input signal pressure causes a decreasing output signal and moves the bellcrank so that a decrease in piston travel is required to restore the system to the original position.

Alternate pipe connections also are provided on the device, so that both the direct-acting and reverse-acting positioners can be connected in circuit for top or bottom loading of the output piston. This allows the device to be piped in such a manner to provide either a fail-safe up or a fail-safe down action, regardless of the desired direction of piston travel, with respect to instrument pressure change.

Because of the pneumatic amplification of instrument pressure provided by the pilot valve, this positioner has a relatively high capacity. It can be used with cylinders up to 12.5 inches dia to provide positioning forces as high as 12,000 lb.

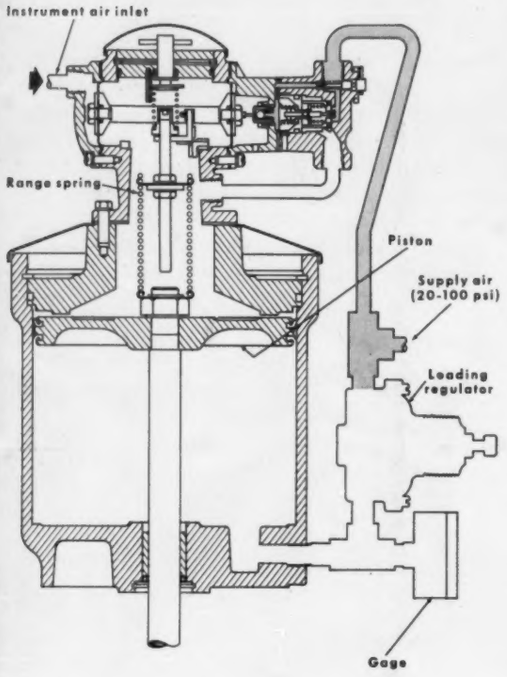
The device is designed and manufactured by the Conoflow Corp., Philadelphia, Pa.





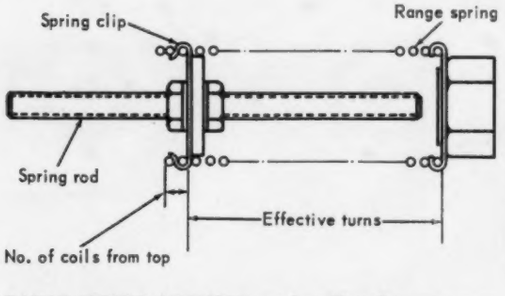
PNEUMATIC POSITIONER combines force-balance design with pilot-operated relay valve. Device operates on 30- to 100-psi supply pressure and five S.A.M.A. instrument pressure spans from 0-3 to 3-27 psi. Device provides four different modes of actuation with range of strokes to give a variety of positioning actions. Typical application shows positioner mounted on cylinder actuator controlling "Lapp Microflo Pulsafeeder" through vertical positioning of wedge shaped cam. (Microflo and Pulsafeeder are registered trademarks of the Lapp Process Equipment Div. of Lapp Insulator Co., Inc.)

Permit Wide Range of Travel

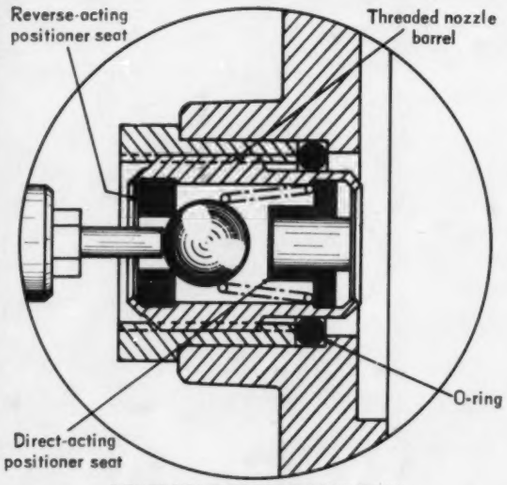


POSITIONER ACTION begins with change in instrument input pressure. Increase causes yoke to move toward pilot valve, moving ball to restrict nozzle opening. Buildup of pressure on pilot diaphragm causes it to move, closing relief port and opening supply valve. Air flows into piston chamber, increasing pressure and moving piston down to position valve. As piston moves down, it stretches range spring supplying feedback force through bellcrank to yoke, returning it to original position. Decrease in instrument pressure reverses procedure, venting output piston pressure.

RANGE SPRING ASSEMBLY

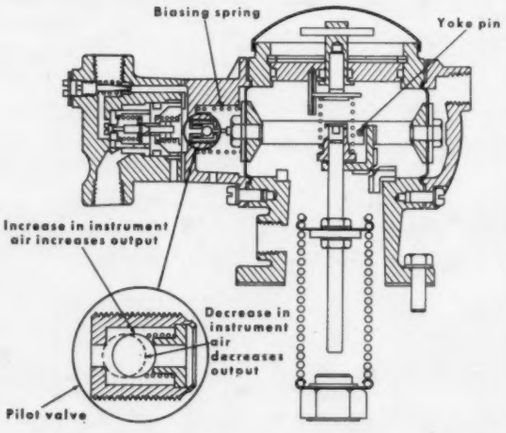


RANGE SPRING ASSEMBLY can be adjusted to vary number of effective coils in accordance with desired travel and instrument pressure span.



REVERSIBLE NOZZLE ASSEMBLY

REVERSIBLE NOZZLE ASSEMBLY is shown set for use in reverse-acting positioner. To convert for use in direct-acting positioner, threaded nozzle barrel is rotated approximately one turn with screwdriver, causing ball to move against opposite seat.



REVERSE-ACTING POSITIONER is obtained by moving pilot valve and yoke pin to opposite side of yoke and reversing nozzle seating. This variation requires additional spring to provide biasing force on yoke pin. With this arrangement, output pressure increases with decreasing input signal pressure. Either version can be adapted to top or bottom of output piston.

IT PAYS TO KNOW **Perma-Nuts®**



EMENEE Got a Much

SIMPLER PLASTIC-TO-METAL ATTACHMENT

"Knowing about the TRS Perma-Nuts when our electric chord organs were designed enabled us to make an almost 'impossible' assembly . . . easily, at low cost and at a high production rate," states Emenee Industries, Inc., New York, world's largest manufacturer of musical toys. "The problem was to attach a reed housing, made of high impact styrene, to a steel turn plate with a threaded fastener. Tapped threads in the styrene would have been subject to stripping. Design of the parts allowed inadequate clearance for a nut, and handling a nut in the semi-blind location would be very difficult, if not impossible."

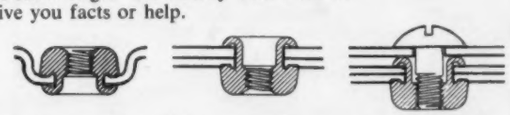


The ideal solution was found in Perma-Nuts, automatically fed and set (just like rivets in metal) by standard TRS riveting machines, air-powered to afford controlled "cushioned" action which clinches Perma-Nut to the styrene without breakage.

Whether *your* attachments are made to metal or plastic, it will pay well to see if Perma-Nuts will do the job. Ample threads in the head for holding power. Sharp serrations under head act as a lockwasher. Head size is same as hex nut of same size. Nine thread sizes, #3-48 to ¼-28 available in steel, brass, aluminum.



SEND for Catalog showing many ways to use these versatile helpers. Or look in "Yellow Pages" for nearby TRS man to give you facts or help.



FLUSH MOUNTED NUT PLATE NUT & RIVET NUT & RIVET & SPACER

TRS® TUBULAR RIVET & STUD COMPANY
QUINCY 70, MASSACHUSETTS

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...are unconditionally warranted, if properly sized on application, and will be replaced FREE OF CHARGE if you experience any trouble.

- Special insulating materials assure longer motor life.
- Special dynamic balancing of rotor.
- Final protective coating of GREEN SEAL epoxy varnish.
- Special bearing lubricant.
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THE LIMA ELECTRIC MOTOR CO., INC.
LIMA, OHIO

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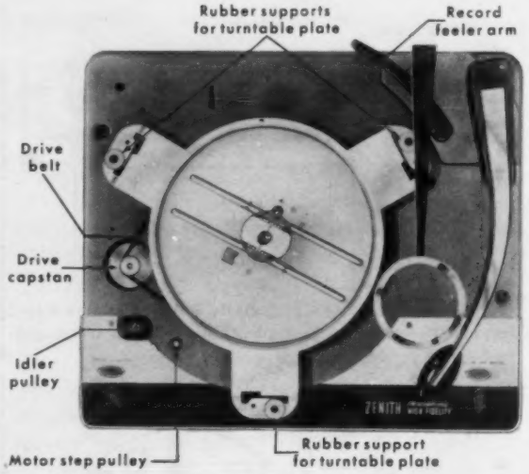
Record-Changer Design Reduces Noise,

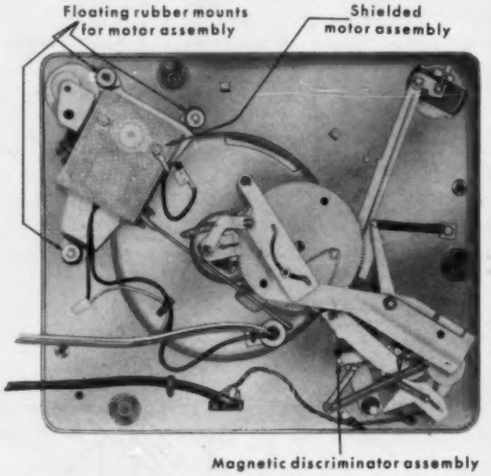
Lars G. Soderholm, Midwest Editor

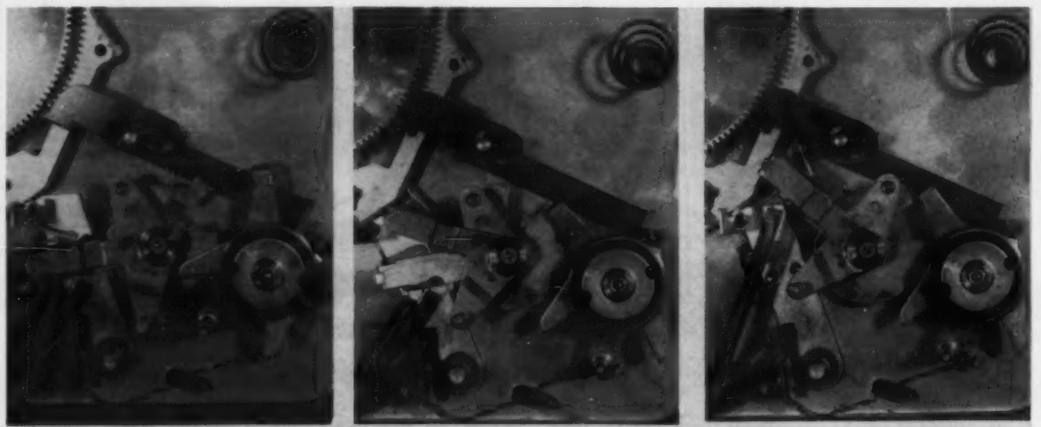
A record changer, designed for use in top-line stereo high-fidelity units for the home, contains design features to reduce unwanted noises and simplify changer operation and record handling.

Elimination of audible rumble is accomplished through isolation of parts. A shaded-pole synchronous motor assembly is mounted on rubber grommets to isolate the base from motor vibrations. A rubber belt transmits power from the motor pulley to the turntable support plate. The top half of the turntable rests on rubber grommets to isolate it from the turntable support plate. In addition, a rubber pad separates the record from contact with the turntable top. The tone arm also is mounted on three rubber grommets. Audible rumble has been eliminated on each channel.

Elimination of flutter and reduction of wow are accomplished by using a heavy turntable assembly



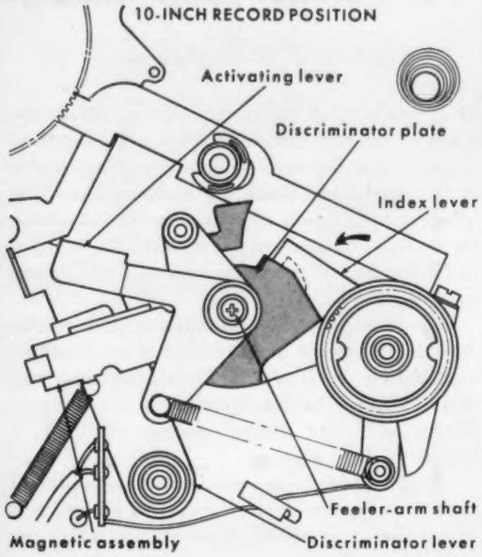




MECHANISM AT REST | 12-INCH RECORD POSITION | SHUT-OFF POSITION

VIEW BELOW BASE PLATE

Simplifies Handling



weighing about 4½ lb. This provides a flywheel effect which tends to iron out speed variations.

Turntable speed is held constant by the synchronous motor and is accurate to a tolerance of minus ½ percent to plus 1½ percent with a 33.33 record speed.

The tone arm is made as long as possible to reduce tracking error. Its 8-9/16-inch length provides a more accurate tracking angle over the whole record. A knife blade bearing is used as an inexpensive way of eliminating friction.

A fold-down 45-rpm spindle of "Delrin" is split to fold flush with the face of the turntable. Lifting the spindle brings both halves up and together.

Record size is sensed by a feeler arm that swings toward the spindle until it feels a record after which it returns to its original position. The magnetic assembly and a discriminator plate move forward with the feeler arm. When contact is made, the magnet assembly returns while the notched discriminator plate is held as the discriminator lever is pulled into its stop. As the tone arm moves inward, the index lever strikes the discriminator plate and the setdown for either 12-, 10- or 7-inch records or automatic shut-off, respectively.

The "Stereo-Professional" record changers are made by the Zenith Radio Corp., Chicago, Ill.

Is there an idea here for you?

Du Pont combines elastomers with fabrics to make versatile FAIRPRENE® – a design material of many uses

Here's how "Fairprene" is serving industry:

Diaphragms for:
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Compressors
Control Devices
Flow Meters
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Distributors

Fabricated into:
Pneumatic Shelters
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Molded into:
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Packings
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Miscellaneous uses:
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Bearing Seals
Fire Curtains
Microphone Covers
Gaskets
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Dielectric Sealing Vents

COATING	FABRIC SUBSTRATES				
	COTTON	NYLON	"DACRON"	GLASS	"TEFLON"
NEOPRENE	●	●		●	
BUNA-N	●	●		●	
"FO"	●	●			
BUTYL	●	●			
"HYPALON"**		●	●	●	
ACRYLIC			●	●	
SILICONE			●	●	●
"VITON"**			●	●	●

Which elastomer-fabric combination is best for your application? The chart above shows the various types of "Fairprene"* available. One of these can probably give you the exact "balance" of properties you need . . . extra-high burst strength with oil resistance . . . flex strength with heat resistance . . . or any degree of the properties offered by the individual components. Clip and mail coupon below for a free booklet giving complete details about "Fairprene" coated fabrics.

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GOODYEAR

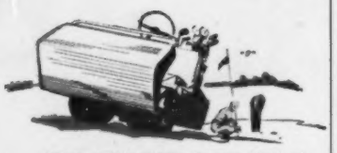
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"Go-anywhere" Terra-Tires by Goodyear open areas barred to vehicles until now

Name your terrain. Chances are, the Terra-Tire by Goodyear can cross it with sure-footed ease when other tires—even tracks—give up.

Steep grades? Vehicles equipped with Terra-Tires can climb the roughest hills—"float" over sand dunes and snow—cruise through swamps and marshland. Virtually punctureproof, tires roll right over sharp objects!

The secret: Traction without compaction—these unique, low-pressure pneumatic tires conform to the ground contour rather than resisting it. And the ride is so cushion-soft that springs, shock-absorbers aren't needed.

The outlook: Unlimited! Terra-Tires can go almost anywhere your imagination takes them—bringing low-cost transportation to high-potential roadless areas. They're available in a wide range of sizes or can be custom-built for you.

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lots of good things come from

GOODYEAR

Terra-Tire —T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

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Parallel-Plane Linkage

E. J. Stefanides, Central States Editor

In a new sewing machine, a linkage which operates in parallel horizontal (x-y) planes is used to transmit and control the horizontal movement of the needle bar along the machine axis. The space-saving location of components made possible by this arrangement has allowed the housing to be restyled to meet requirements established by an industrial design study.

In previous models, an oscillating-plate mechanism, located in the center section of the machine, was used for this function. The transmission portion of this mechanism operated in vertical (y-z) planes, while the control portion operated in horizontal (x-y) planes.

The design of the new mechanism was initiated after experiments with wooden mock-ups had shown that it would be impossible to adapt the previous mechanism to the space envelope requirements of the new model.

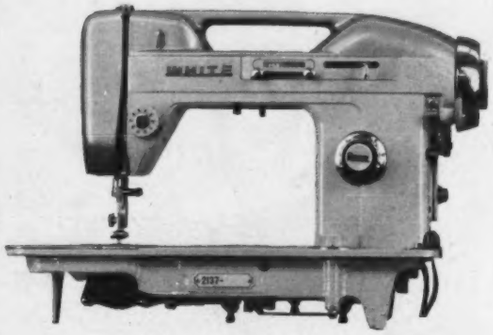
The new model housing was designed to show a "slim-line" or less massive appearance and incorporates a handle at the top center of the machine to facilitate raising and lowering of the overhung mass of the sewing head. The inclusion of the handle was an important consideration, since the majority of machines in use are placed against a wall in a position which makes it difficult to get a firm grip on the sewing head.

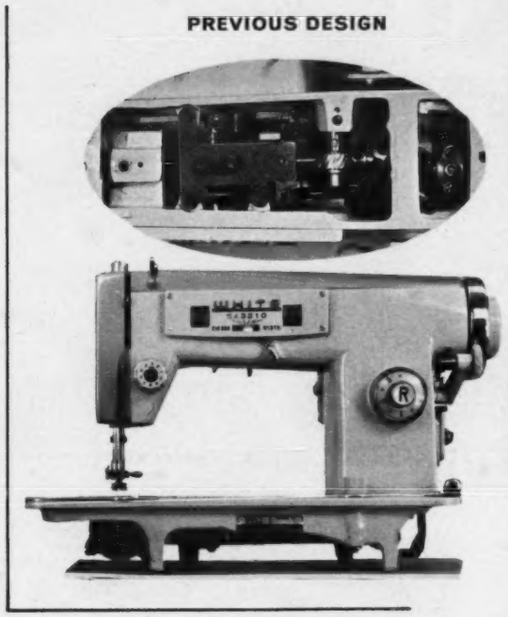
Use of the new mechanism has allowed considerable reduction in the vertical thickness of the center section required in the new housing. Almost all of its components are now located to the rear of the machine above and below the main drive crank and arm shaft. The only components now located in the reduced center section are the arm shaft, which drives the needle bar, and a connecting rod, which transmits the axial horizontal motion to the needle bar.

The new mechanism, besides providing all of the functional advantages of the previous design, also has allowed a simpler control layout to better harmonize with the restyled housing.

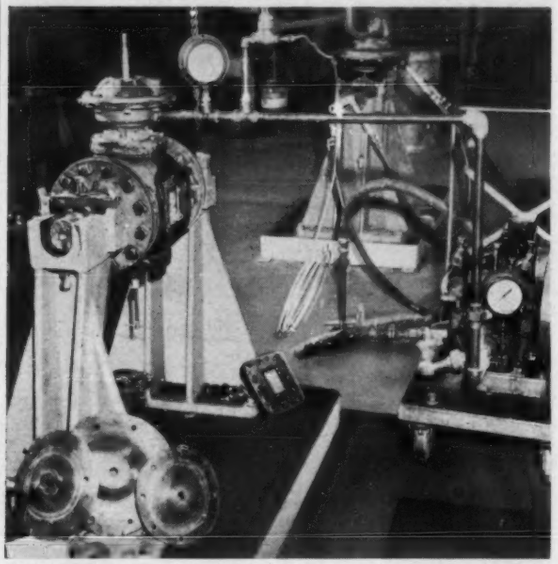
These industrial and mechanical design features are incorporated in a new White Model 2137 sewing machine, designed by the White Sewing Machine Corp., Cleveland, Ohio. The industrial design work was done by Richard H. Arbib of New York.

Solves Industrial Design Problem





DIAPHRAGM OF REEVECOTE WITHSTANDS 23,520 LB. THRUST IN SAFETY TEST



Safety tests for gas regulator diaphragms are run by Reynolds on this device fed by a hydraulic pump. Here, on an effective area of 24 sq. in., a Reevecote synthetic diaphragm safely absorbed a total thrust of 23,520 lbs.

The Reynolds Gas Regulator Co., of Anderson, Ind., takes unusual safety precautions to check the tensile strength of diaphragms in their gas regulators.

Some of their diaphragms must absorb sudden surges in pressure—up to 1000 psi. That's why Reynolds runs special safety tests on the diaphragms.

The results of these tests prove the outstanding superiority of diaphragms made of Reevecote.

In a recent test at Reynolds, Reevecote 7270, 0.093" gauge a Buna-N coated nylon, successfully withstood 980 psi on an effective diameter of 24 sq. in.—or a total thrust of 23,520 pounds.

Reevecote diaphragms are flexible and sensitive, yet tough enough to stand up safely under severe extremes of pressure.

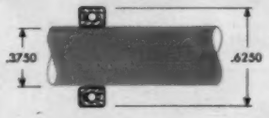
If your design calls for the use of diaphragms, or coated fabrics—choose from the most complete source of coated fabrics for industry—REEVECOTE.

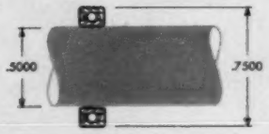
REEVES VULCAN

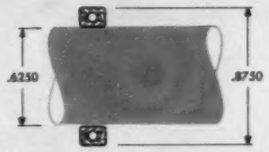
Reeves Brothers, Inc., Vulcan Rubber Products Division
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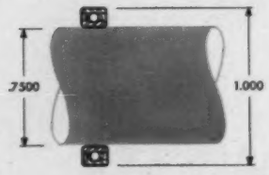
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NEW Instrument Bearings from NEW HAMPSHIRE Let You Beef Up The Shaft Without Increasing Bearing O.D.









Here are four new opportunities to design shaft-to-housing relationships not possible with other bearings. As shown in the sketches, thinner bearing cross sections permit extra-large Bore-to-O.D. ratios.

This new series is manufactured to ABEC-5 precision standards or better, of stainless 440C steel, with plastic crown retainers which absorb lubrication.

BORE +.0000 −.0002	OUTSIDE DIAMETER +.0000 −.0002	WIDTH +.000 −.001	BEARING NUMBER	RADIUS	LAND DIAMETERS INNER	LAND DIAMETERS OUTER	BALLS NO.	BALLS SIZE	C RATING
.3750	.6250	.1562	SR6 20T	.010	.457	.542	12	1/16	81
.5000	.7500	.1562	SR8 24T	.010	.587	.672	16	1/16	95
.6250	.8750	.1562	SR10 28T	.010	.712	.797	18	1/16	98
.7500	1.0000	.1562	SR12 32T	.010	.837	.922	22	1/16	108

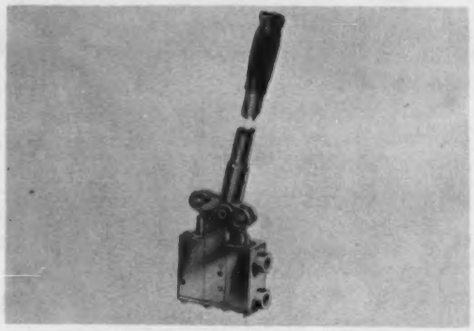
Write for full information or call in your New Hampshire Sales Engineer for application assistance.

NEW HAMPSHIRE BALL BEARINGS, INC.
PETERBOROUGH, N. H.

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Piston Ring Doubles

Ronald W. E. Martin, British Editor



In a compact, double-acting hydraulic hand pump, the piston ring rubber seal also serves as a delivery valve. The ring is slack in its groove but has an interference fit in the bore. According to piston movement, the ring moves to one end or the other of its slack to permit fluid flow.

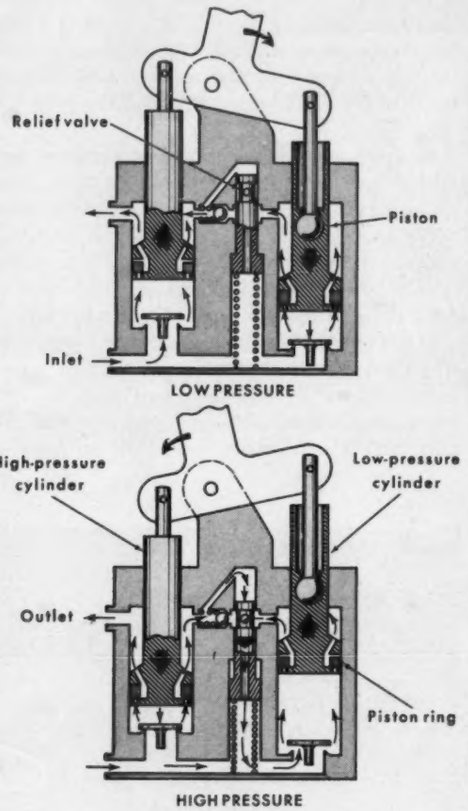
Combining the advantage of a low-pressure, large-flow pump with that of a high-pressure, small-flow type, the unit uses two pumps of the same bore, one having twice the stroke of the other. An automatic cutout valve is positioned between them. When pressure rises to a pre-determined amount, the load automatically cuts out the long-stroke pump, allowing operator to carry on pumping with reduced delivery to a higher pressure. Each pump is of the differential type, being double-acting, but containing only one inlet and one outlet valve.

On upward piston stroke, the piston ring seals a series of drillings in lower half of piston and fluid trapped above the piston is forced out of the pump. On the downward stroke, the ring moves away from these drillings. This allows fluid to pass through transfer holes in the upper half of the piston to an annular space above.

On downward stroke, piston is inoperative and displacement is caused solely by the piston rod. The piston rod area is equal to the annular space between rod and the bore of the barrel. Thus, the same amount of fluid is pumped during both up and down strokes. Combined output of pumps minimizes manual effort and permits high pressure to be reached quickly.

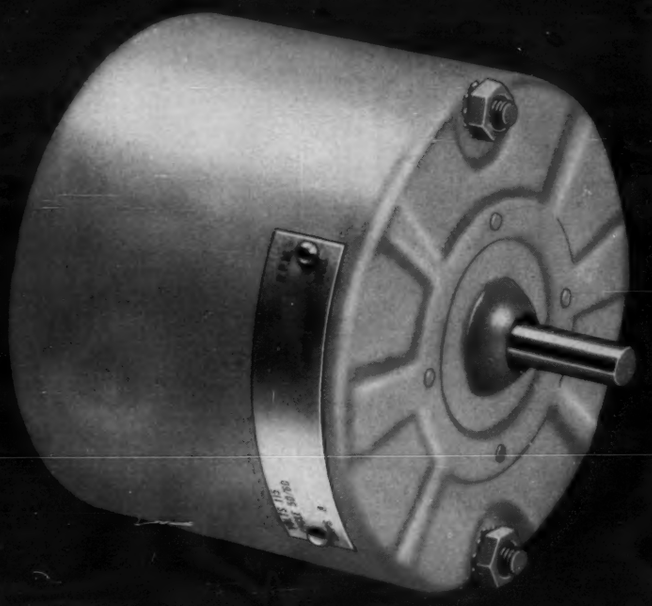
Intended for operation of hydraulic circuits, the pump is manufactured by Turner Mfg. Co., Ltd., Wolverhampton, England.

as Delivery Valve in Hand Pump



PRINCIPLE OF OPERATION with both cylinders pumping at low pressure (top). As piston rises, fluid from inlet gallery is drawn via poppet-type valve into cylinder space below piston head, while fluid in cylinder space above piston is discharged. During this stroke, rubber ring moves to lowest position in its groove, thus closing transfer holes in piston. On piston downward stroke, fluid below piston passes via holes in piston head into upper cylinder, but because of piston rod area, only half of fluid transferred can be accommodated. Remainder of fluid is ejected by positive displacement through delivery port. Small passage in pump body connects delivery port with space above relief valve. When delivery pressure reaches predetermined figure, valve is forced down against spring and waisted portion aligns with delivery port. Simultaneously, ball is forced onto its seat to seal off duct between high- and low-pressure cylinders. In lower diagram, low-pressure piston is idling since fluid flows through passages in relief valve to inlet gallery. Cycle for high-pressure cylinder remains same as before. As pressure in delivery line falls, relief valve returns to its original position and both pistons again become inoperative.

SPECIFY LEECE-NEVILLE MOTORS FOR QUALITY, RUGGED DESIGN, LONG LIFE



INDUSTRY STANDARD—3-1/4" Shaded Pole. 4 Pole—1550 rpm—1/150 to 1/25 hp. For use on fans, ventilators, small blowers, etc. Model No.4C.



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SINCE 1909

LEECE-NEVILLE now offers you a complete line of shaded pole and permanent split capacitor motors—basic units adapted to your specifications, or special motors custom engineered to your requirements—with horsepower ratings from 1/150 to 1/2 hp. All L-N motors are capable of meeting U.L. and C.S.A. application tests. Leece-Neville has more than 50 years of experience manufacturing motors and other electrical equipment, and modern facilities assure not only top quality, but also delivery to your schedules and lead times. For full information, just mail the coupon at right.

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Please forward details on your shaded pole and permanent split capacitor motors.

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HOKE Flow Sheet 5

HOKE REPORTS ON FLUID CONTROL

WE'VE TOSSED A NEW BALL INTO AN OLD GAME

A VALVE NAMED "DESIRE"

With apologies to Tennessee Williams, we really have produced a Solenoid Valve line based on *your* desires. We surveyed all the solenoid valve users we could find to determine what *you* wanted. The result is Hoke's "User Designed" Series 90 and 95, two-way and three-way, direct-acting solenoid valve line.

Thanks to you, we have much to brag about. Here's what we have been saying about these new valves: lightest weight – smallest size – no-hum operation – lowest temperature rise – lowest power consumption – stainless steel plunger – silver AC shading coils – easiest installation – packless construction – 360° rotatable housing – operates in any position.



We make them of forged brass or stainless steel, in ⅛" and ¼" NPT size or JIC tube ends. There's a variety of AC and DC voltages. Class "A" coils are standard, but Class "H" are also available for temperatures above 212°F. For those with high insurance rates, we can supply explosion proof coil housings.

Now that we've bragged a bit, we must also apologize for our premature enthusiasm. We were so excited about this product that we stirred up a hornet's nest of interest before we were ready to deliver in quantity. Shipments were slow at the start, but now we can have any reasonable quantity of these "desirable" solenoid valves "on-stream" in your plant when you want them.

There's only one way to get conclusive performance proof – buy a valve. Ask for Bulletin SV-4-61.

A STEADY FLOW OF FACTS!

Further flow features, and interesting technical topics are carefully covered in Hoke's technical publication, the FLOW SHEET. It's free, but worth millions! To get the full benefit of our engineering and editorial efforts six times a year, mark your "X" in the proper box.

The technique of molding polyvinyl chloride into ball valve parts is old hat. Even the unplasticized compounds of type I PVC have been kicked around for a while (with minor successes). But until now, no one has booted the ball for a goal.

Perseverance, determination, and the pursuit of economic reward have prompted us to offer a line of ball valves molded of the toughest grade of type I, unplasticized PVC. There are no foreign agents to contribute to a corrosive demise, even in most caustic services. It even meets the proposed new ASTM specification and has a tensile strength of 8500 psi. Those who have had PVC piping problems will profit from the new molding process that gives these Hokes dimensional stability and very high impact strength. Sensitive systems, human and otherwise, are safe from contamination – they're absolutely non-toxic. We've set 140°F. as the operating temperature limit, but occasional excursions to 160°F. won't do any harm.

All standard models are supplied with a concentric hole drilled thru the ball. They can be heat welded, or solvent bonded right in the line. Piping hook-up is even simplified by their coupling-like assembly. Your assistant can fit each half of the valve to a pipe end, then reassemble the valve without having to turn the pipe. Pressures to 125 psi are duck soup for these valves.

A maintenance man's delight, they can be cleaned and have their seats changed without leaving the pipe. Their light weight makes them ideal for use on long, unsupported spans of pipe.



Size-wise, we're offering them in ½, ¾, 1, 1½, 2, and 3 inch sizes, all NPT female connections.

You will command the eternal admiration of your colleagues when you install these valves. Be the first to show your rightful status by ordering a shiny new Hoke polyvinyl chloride ball valve. If pride of ownership hasn't motivated you at this point, the mere fact that you are behind the scientific times should move you to find out more.

It isn't necessary to tell us why you want the additional information. Just check the coupon below. We'll forward the facts in a plain, brown envelope.

'61 PRODUCT PARADE

You'd be surprised at some of the screwball ways our valves have been used (to decided advantage, of course). Hoke distributors are armed to their maxillary third molars with this method madness and will redesign your systems (incorporating solenoid valves and PVC ball valves) at the drop of a postcard. Check the PRODUCT PARADE box.

Hoke's Performance Guarantee — *Every Valve Leak-Tested!*

HOKE, INCORPORATED
89 Piermont Road, Cresskill, N. J.

Send me complete information on the Hoke products checked below:

- ☐ PVC Ball Valves
- ☐ Solenoid Valves
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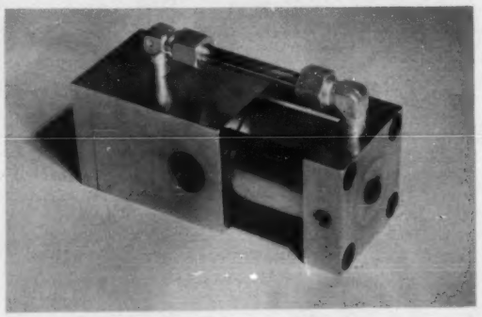
Low Pilot Pressure

Lars G. Soderholm, Midwest Editor

A 1-inch high-pressure check and relief valve controls fluid pressures up to 7500 psi using a very low comparative pilot pressure. This is possible through a bleed tube that connects high-pressure input of the valve with a cavity in the pilot piston.

In operation, the balancing of pressures permits a state of equilibrium between fluid force acting on the check ball and opposing force from the pilot piston. In the balanced condition the pilot piston need only act against a light spring holding the check ball on its seat regardless of what the actual pressure may be in the valve.

When operating as a check valve, the high pressure fluid to be vented or flow-controlled is connected to port "B" behind the ball check. To vent high-pressure fluid through the valve and out port "A", it is necessary to provide an external

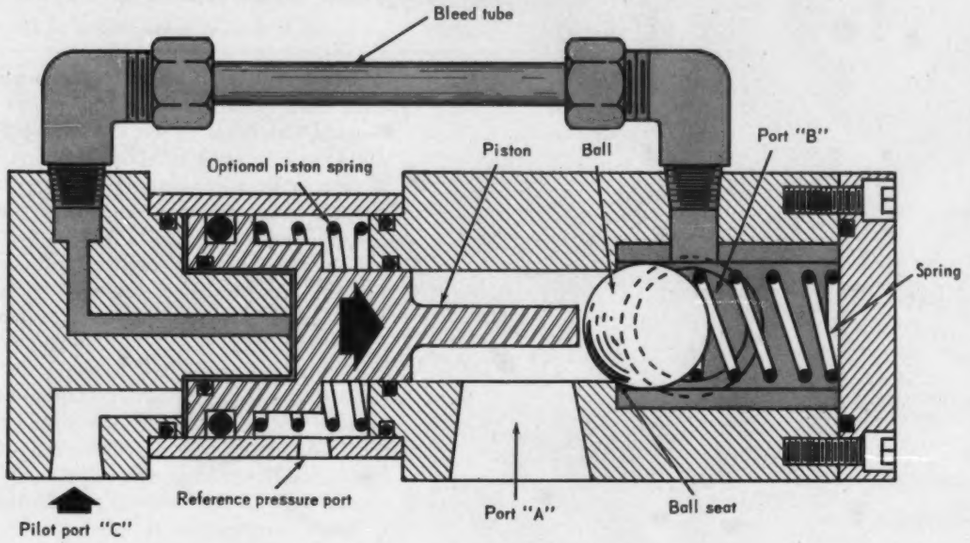


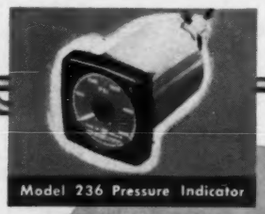
pilot pressure at port "C" sufficient to overcome the spring force holding the ball in its seat.

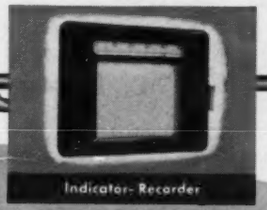
Rate of flow through the valve can be controlled since valve opening is determined by the position of the ball, which is in turn fixed by the amount of pilot pressure applied. The pilot piston is returned by a spring. For more accurate control a connection can be made into the chamber to eliminate the spring and to provide a reference pressure to oppose external pilot pressure if desired.

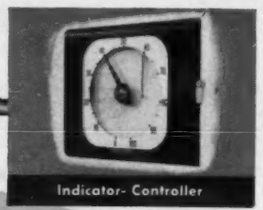
This valve is 8 inches long, 3¼ inches square and is constructed of CR 1018 steel, unless otherwise ordered. O-ring seals are used throughout the valve. The 1-inch check and relief valve is made by Studebaker Hydraulic Products Co., Bellwood, Ill. (patent pending).

Controls High-Pressure Flow in Equalized Valve




Model 236 Pressure Indicator


Indicator-Recorder


Indicator-Controller

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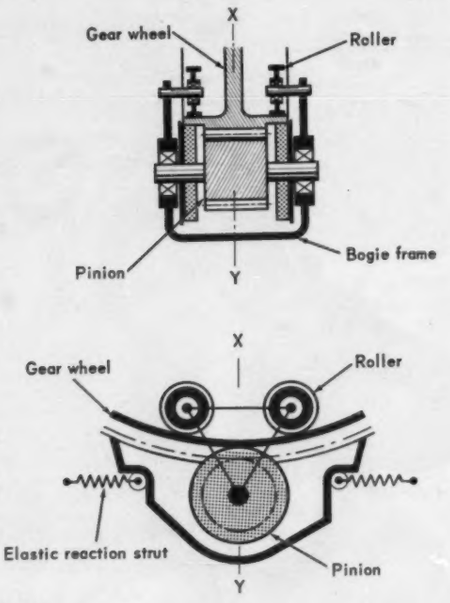
Floating Gear Reduction

G. B. Bernard, Correspondent in France

The widened rim of a driven gear provides a circular track on each side for a four-wheel carriage (bogie). The bogie carries a driving gear pinion and is held in place by elastic supports. Relative motion between pinion and driven gear thus is possible which provides controllable elasticity in the gear train.

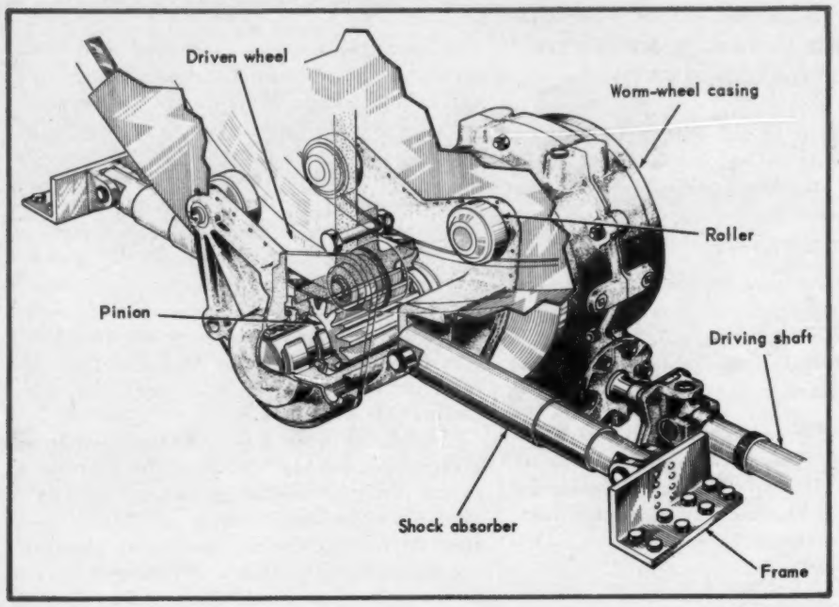
Compensation for eccentricity and nonparallelism is automatic. Shock loads on the speed reducer attached to the pinion are absorbed by elastic members, damped or undamped. Transmission torque can be monitored by the displacement of the bogie. In other applications, several pinions can be applied to the same gear wheel with automatic load distribution and without need for differential gear boxes.

The bogie-pinion, floating gear transmission is a design development of Societe des Engrenages Durand, Paris, France.

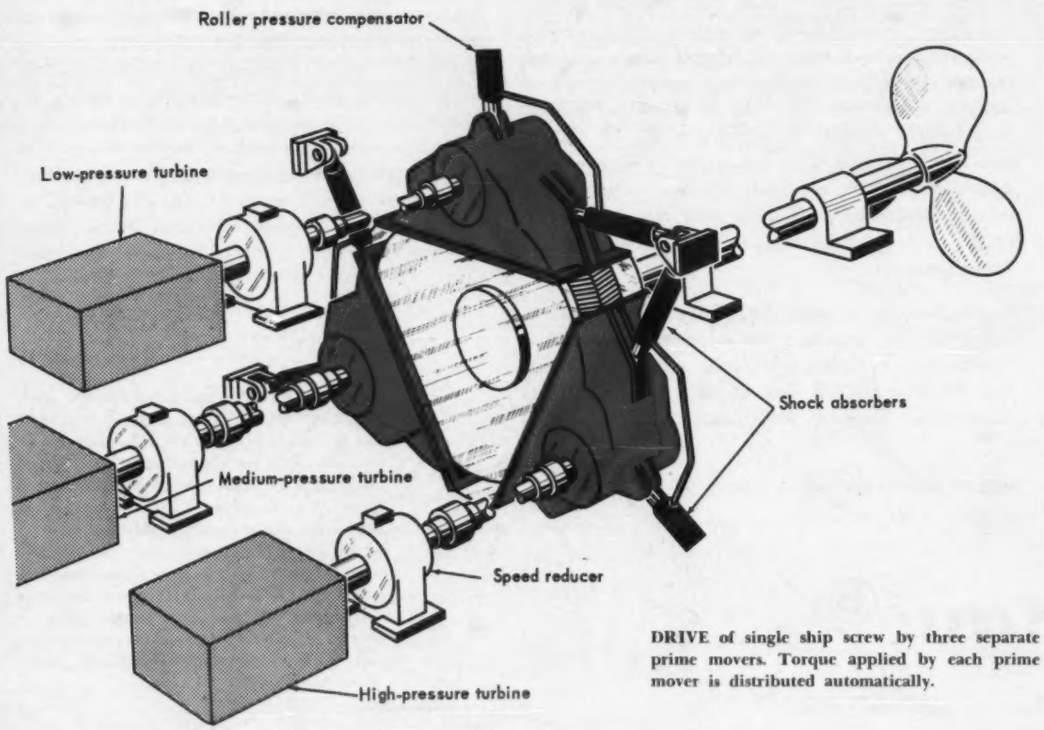


PINION rotates in bogie frame whose four rollers hold it to rim of gear wheel. Pinion bogie is supported by elastic struts which transmit reaction forces. Small rotation on XY axis is allowed by bogie to absorb inaccuracies of teeth and nonparallelism of pinion and wheel shafts.

Links Drive Pinion and Driven Wheel



WORM REDUCER drives pinion, rotating on ball bearings in bogie frame. Four rollers carry bogie on driven gear. Two shock-absorbing elastic struts absorb reaction forces.



DRIVE of single ship screw by three separate prime movers. Torque applied by each prime mover is distributed automatically.



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An Entirely New Design Concept For the Actuation Engineer!



SAGINAW b/b SCREW WITH TORQUE LIMITER FREE WHEELS AT BOTH ENDS OF ACTUATOR STROKE

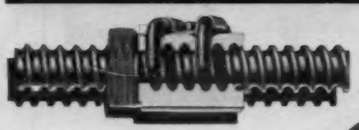
With the introduction of the Torque Limiter for Saginaw Ball Bearing Screws, actuator design has made a significant step forward. That's because the Torque Limiter permits b/b screws to free wheel at both ends of the actuator stroke at normal loads.

Designed to overcome load limitations common to conventional free wheeling b/b screws, the Torque Limiter may be used with any size Saginaw b/b Screw. The only load limitation is the design capability of the basic screw.

Integral stops on the screw shaft precisely control the length of the stroke. When the ball nut reaches either stop, it free wheels. The drive energy is absorbed by the Torque Limiter. Loading may be tension, compression, or a combination of both.

Some areas in which Saginaw b/b Screws with the Torque Limiter can be used are: *Overload Protection* for motors when the actuator reaches travel limits; *Overtravel Protection* in case limit switches fail to stop drive; *Exact Positioning* without other complex positioning systems due to integral stops; *Holding Devices* where drive continues to operate at end of actuator stroke until reversed to release; *Forward-Stop-Reverse Systems* where motors can be smaller and less expensive since instantaneous reversing at drive limits is not required; *Stepless Actuation* for precise, controlled positioning with repeatable accuracy . . . an inherent advantage of all Saginaw b/b screw actuators.

If you have an actuator design problem, we will be happy to help you find the solution. Write, Chief Applications Engineer, b/b Screw and Spline Operation, Saginaw Steering Gear Division, General Motors Corporation, Saginaw, Michigan.



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Saginaw ball bearing Screw

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Spring Alternately Stores

Edward W. Schrader, Western Editor

The spring in a ratchet and pawl mechanism overcomes the problem of excessive heat generation at high speeds. Many incremental drive devices for feeding punched cards column-by-column past a read or punch station are also difficult to clutch at high speeds.

In this design, the ratchet notches have sides substantially parallel for the major portion of the notch depth. Each notch holds the pawl for a much longer portion of the drive cycle than a conventional notch with more rounded sides. This allows maximum return of the kinetic energy from the decelerating load and from the other drive parts through the pawl and its actuating arm to the spring.

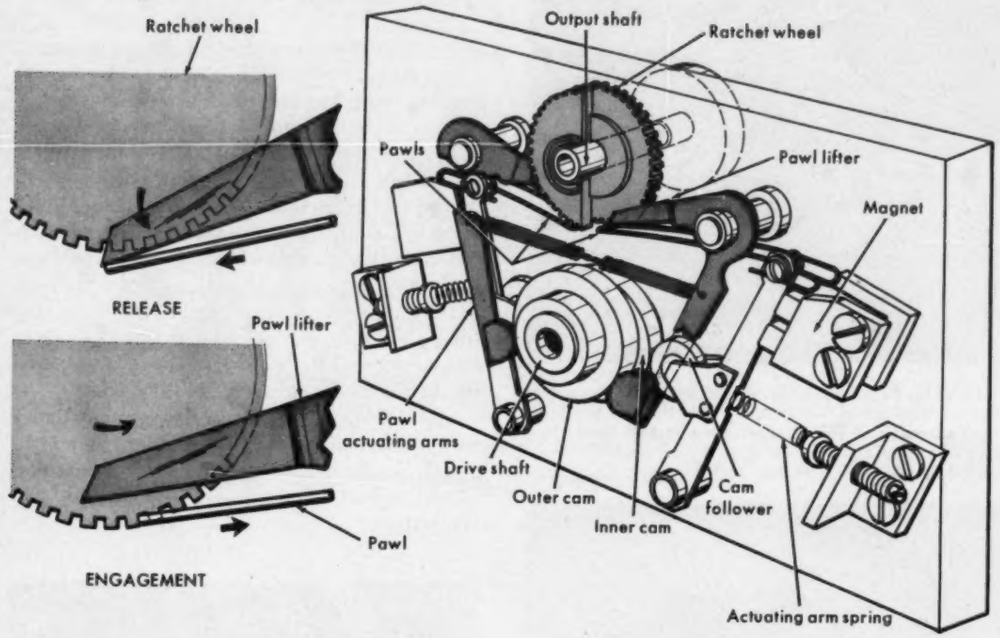
The spring not only maintains continuous pressure against the actuating arm to hold it against the cam, but, of greater significance, it also stores the kinetic energy transmitted to it from the moving load and mechanism parts during deceleration. It releases this energy for re-use in the subsequent acceleration stroke. This alternating storage and release of energy avoids the heat generation problem.

The device can perform three operations in any desired sequence. In response to the control magnets, it will: (1) impart incremental motion to the output shaft, intermittently in either direction; (2) oscillate the output shaft, and (3) hold the output shaft still.

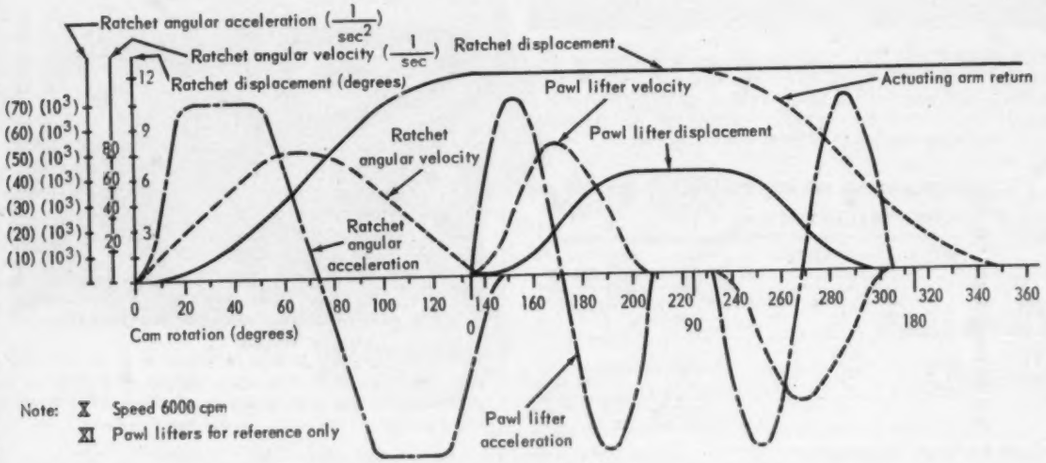
The high-speed, clutchable incremental drive is an invention of Gunter H. Schacht and L. A. Wilson, General Products Division Development Laboratory, International Business Machines Corp., San Jose, Calif.

ACCELERATION, DECELERATION AND DISPLACEMENT-VERSUS-TIME RATIOS can be varied as required. Displacement-versus-time ratios are controlled by cam design. Diagram is for robot-run test to incrementally move cards weighing 2.5 grams at rate of 6000 steps per minute, or oscillate them at 12,000 steps per minute, with displacement of 0.087 inch. Curves shown are those obtained for one pawl actuating arm and lifter during one complete cycle. Release pulse on control magnet may occur any time while cam follower is on high dwell area of cam (period of 2.5 milliseconds).

and Releases Kinetic Energy in Incremental Drive



INCREMENTAL DRIVE is powered by continuously running unidirectional motor. As drive shaft rotates, inner cam moves two spring-loaded, pawl-actuating arms back and forth in opposite phase. Cam follower on arm pivots arm to move wire pawl. Wire pawl is rectangular shape; it engages notch in ratchet wheel mounted on output shaft to drive feed roll. Outer cam drives spring-loaded pawl lifters. As cam follower for each lifter reaches high point of outer cam, lifter moves down between wheels and forces end of its pawl out of engagement with ratchet notch. Each control magnet, mounted close to maximum point of arm swing, includes two windings; one is energized continuously and develops sufficient field to hold pawl actuating arm at maximum position, thus locking it out of operation. Second winding is normally not energized; when pulsed, it develops field which strongly opposes existing field of first winding and net flux approaches zero in gap to release pawl actuating arm.



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Available in flange sizes ranging from ½" to 5".

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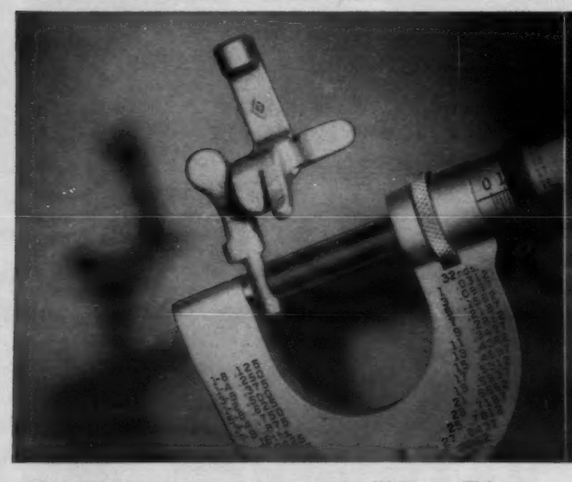
THIS INTRICATE FORGED PART WILL GIVE YOU NEW IDEAS...



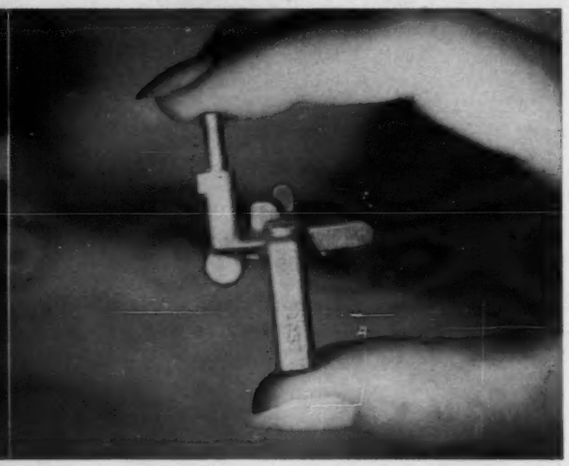
ON STRENGTH Insurance against equipment failure was the primary specification for this steel part for an electronic key punch machine. A Williams forging was selected to give the required strength and toughness for greatest dependability during high speed operations.



ON SHAPE The complicated contours of this part require controlled grain flow in many directions to provide maximum strength at points of greatest stress. Here the desired result was achieved by a parting line that is a complex intersection of 5 planes and 2 curved surfaces.



ON SIZE No part is too small for Williams. This part weighs only ½ ounce, yet Williams forging designers give the same attention to quality and cost of manufacture within close tolerances as they do to large forgings weighing up to 250 lbs.



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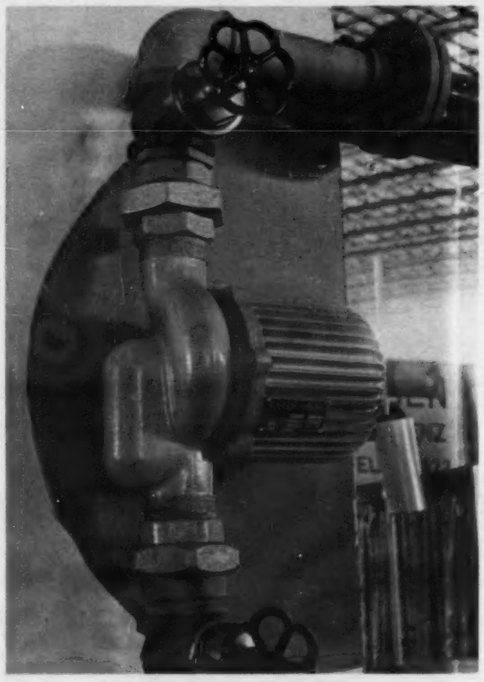
Bypassed Water

Celestino O. Lubatti, Italian Editor

Water from the delivery pipe is passed through a pump motor to provide cooling and to make stuffing boxes unnecessary. The resulting motor-pump circulating unit for heating systems is said to be considerably smaller and lighter than others.

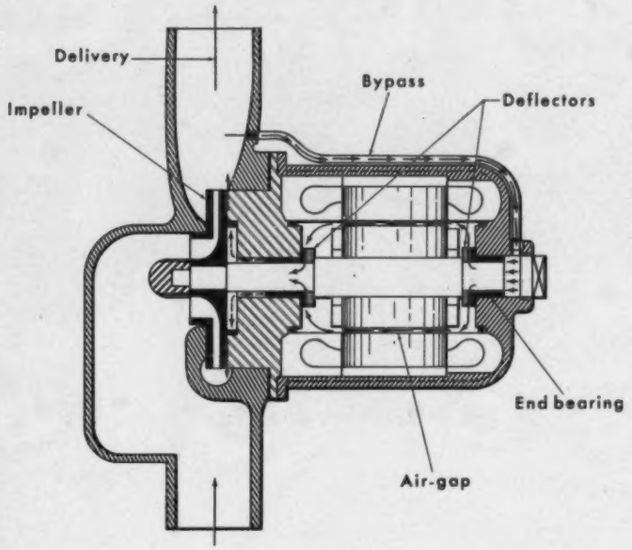
The bypass pipe carries a small portion of the pumped water directly to the end bearing, which is the one most subject to frictional heat. Grooves in the bearings and the air gap between rotor and stator form longitudinal passages. Deflector rings facing the bearings direct water radially to and from the bearings. Hot water flowing axially against the impeller is ejected into the pump case through impeller clearance.

External bypass permits use of a common flange motor, obviates the need for complex round-trip passages in the motor case. The pump was patented and is produced by Pompe Ruggeri SpA, Milan, Italy.



COMPACT DESIGN permits placement of pump between pipe connectors of heating plant without additional supports. Various models are available to permit 700 to 50,000 liters per hour (186-13,250 gal per hour) delivery.

Seals and Cools Pump Motor



BYPASSED WATER provides efficient bearing lubrication and cooling for hot-water pump. Relatively large passages formed by impeller allow water circulation through heating plant when pump is stopped.

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Precise tolerances within ±0.003 in. are now possible in large volume production of custom-molded rubber component parts. Ohio Rubber's new high-speed, continuous molding process produces such parts at rates of up to 200,000 pieces per day.

Greater precision, which results in important savings on finishing costs, is assured through use of single-cavity, self-registering molds. They permit accurate, uniform application of pressure to minimize flash—maintain consistent tolerances for all dimensions. Uniform material thickness is equally assured by a plasticizing mill, which as an integrated part of the process directs uniform charges to each mold.

Direct feeding, from the mill to the mold wheel, eliminates the conventional intermediate extrusion step and further insures part uniformity and quality consistent with specifications. The continuous process permits *precise* control of time and temperature for each part.

Large volume production results in substantial cost savings for small, precision parts requiring tolerances obtainable by other precision molding processes. For parts formed by less precise, conventional methods, performance can be improved through greater accuracy—and without prohibitive increase in cost.

Quantity requirements involving 500,000 or more parts annually are recommended for most advantageous use of the new process. Since two similar parts of different size can be produced simultaneously by alternating the molds on the molding wheel, lower production runs which might not be economical can be combined with a separate order.

Complete information on this revolutionary new process is available in bulletin form. Send for your free copy today. At the same time, be sure to inquire about Ohio Rubber's complete component "Customeering" service—molding, extruding, and bonding-to-metal. Just mention ORCO Bulletin 715.

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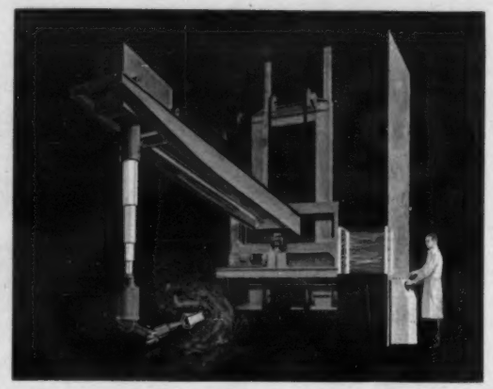
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Recirculating Ball Splines

Robert L. Candlish, Detroit Editor



Multiple, extending ball-bearing splines in the design of a mechanical arm have improved the versatility and efficiency of the telescoping hoist unit. The telescoping member is made from a series of concentric tubes, collapsible inside each other. Circuits of balls riding in grooves in the tubes provide a key effect between adjacent tubes. This arrangement provides high efficiency by providing rolling action under any load condition when the tubes move axially, one within the other.

The mechanical arm hoist used for the handling of radioactive material is a development of the Nuclear Equipment Dept., Mechanical Div., General Mills, Inc. The Saginaw Steering Gear Div., General Motors Corp., supplier of the multiple-extending ball-bearing splines, cooperated on the spline design application.



RECIRCULATING ACTION OF BALLS is provided by ball pickup finger extending into path of balls, deflecting them into tubular carrier that returns them to opposite end of load-carrying circuits. This recirculation prevents balls from becoming trapped in one end of groove, where balls would have sliding instead of rolling action when tubes have to move in direction of trapped balls.

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hoover quality

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It's easier to strike a match on plate glass than on the smooth surface of a Hoover bearing raceway. A special process, developed and used only by Hoover, hones raceways until they are ultra smooth, superbly finished. With both inner and outer raceways *Hoover Honed* to microscopic perfection, Hoover ball bearings have a distinctive quality advantage.

Equally important as the *Hoover Honed* raceways are carefully matched sets of *Micro-Velvet* balls which are accurate within millionths of an inch. These precision components work together in hushed quietness, an excellent indication of bearing quality and a characteristic of all Hoover bearings.

Outstanding quality—*Hoover Quality*—pays off in longer life, greater load capacity and superior bearing performance in a wide range of applications.

Hoover Honed and *Micro-Velvet* are Hoover Trademarks

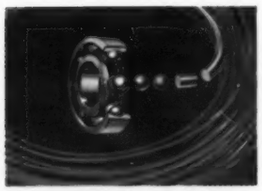
hoover

BALL AND BEARING COMPANY

5400 South State Road, Ann Arbor, Michigan

Zone Sales Offices and Warehouses	8581 South Chicago Ave., Chicago 17, Illinois 290 Lodi Street, Hackensack, New Jersey 2020 South Figueroa, Los Angeles 7, California

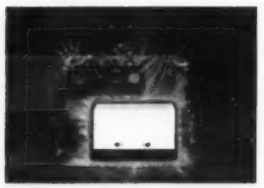
hoover CONTROLS *hoover quality* FROM START TO FINISH



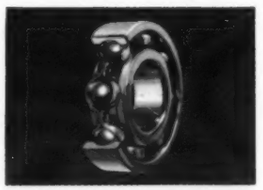
Hoover's Cuyahoga Steel and Wire Division produces quality chrome alloy steel wire from which balls are made.



Micro-Velvet balls are products of Hoover Ball Division plants in Middletown, Ohio, and Erwin, Tennessee.



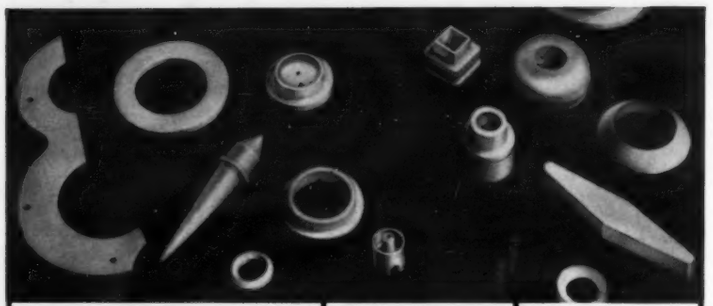
Non-destructive electronic testing devices check bearing parts for tolerance, hardness and hidden flaws.



Hoover bearings in a wide range of types and sizes always measure up to high *Hoover Quality* standards.



PLASTICS
in Design Engineering



PROPERTY	TEFLON (TFE)	TEFLON (FEP)
Specific Gravity	2.1-2.2	2.1-2.2
Tensile Strength, 73°F	2500-3000 psi[a]	2700-3100 psi
Elongation, 73°F	100-200%	250-330%
Compressive Stress at 1% Offset	1000 psi	700 psi
Impact Strength, Izod Notched, 77°F	3.0 ft. lb./in. of notch	Does not break
Heat Distortion Temp., 66 p.s.i.	270°F	162°F
Coefficient of Linear Thermal Expansion (Approximate Values per °F)	5.5×10^{-5} in./in./°F	5.23×10^{-5} in./in./°F
Dielectric Strength, Short Time, 1/16"	400-500 v/mil[b]	400-500 v/mil[b]
Surface Arc-Resistance	700 seconds[c]	165 seconds[d]
Volume Resistivity	$>10^{15}$ ohm-cm.	2×10^{15} ohm-cm.
Dielectric Constant (60 Cycles)	2.0	2.2
Service Temperature Range (Max.)	+500°F	+400°F
Service Temperature Range (Min.)	−395°F	−395°F
Water Absorption	0.0%	0.0%
Flammability	Nonflammable	Nonflammable

(a) Tensile strength in oriented film may be as high as 15,000 psi.

(b) Value is 1000-2000 v/mil in thicknesses of 5 to 12 mils.

(c) Does not track.

(d) Samples melted in arc after 15 seconds, but did not carbon track.

This table compares the properties of Teflon* TFE and FEP. The newer FEP can be injection molded. In designing, consult your Garlock plastics specialist for best application results.

In designing intricate parts, consider the benefits of Teflon as a material.

Teflon offers a unique combination of properties unmatched by other plastics. It possesses the lowest coefficient of friction, the best non-stick characteristics, the most complete chemical resistance and the widest useable temperature range available in any plastic. Teflon eliminates lubrication, corrosion, contamination, seizing; it reduces friction, wear, space required, weight. Teflon can be used in a thousand different ways—for packings, gaskets and seals . . . for connectors, insulators, and test points . . . for valves, bearings, couplings, and insulation.

In producing intricate Teflon parts, consider the benefits of Garlock as a supplier. From virgin powder to finished piece, Garlock closely controls each step in the process to assure that the final part performs to your expectations. Complete facilities are at your disposal for molding, extruding, and machining of Teflon. If your application calls for special properties, Garlock will compound Teflon with selected fillers to greatly extend its service range. If you need unusually large configurations, Garlock will fusion-weld Teflon . . . the weld will have the same thermal, chemical and electrical properties as the Teflon itself.

Parts made from Nylon, Delrin*, C.T.F.E., Lexan† are also available from Garlock. Let your local Garlock representative quote on your design, or ask his assistance on any design problems concerning materials and applications. Call him at the nearest of the 26 Garlock sales offices throughout the U.S. and Canada. Or, write for Catalog AD-177. Garlock Inc., Palmyra, N.Y.

GARLOCK

Canadian Div.: Garlock of Canada Ltd.

Plastics Div.: United States Gasket Company

Order from the Garlock 2,000 . . . two thousand different styles of Packings, Gaskets, Seals, Molded and Extruded Rubber, Plastic Products.

*DuPont Trademark
†General Electric Trademark

Circle 31 on Reader-Service Card for more information

Facilitate Remote Handling

TELESCOPING MECHANICAL-ARM HOIST is designed for remote handling of radioactive material. Telescoping member must extend and retract up to 28½ ft at speeds ranging from 10 to 30 fpm. Load capacity varies up to 5000 lb with simultaneous end couple of 560 ft lb and torque of 350 ft lb.



TELESCOPING TUBES are made from hard-enable grade of stainless steel. This provides high load-carrying capacity and prevents balls from Brinelling race grooves. Stainless material has high resistance to contamination from radio-active atmosphere and is corrosion resistant when cleaned with steam or detergent.

Some Ideas

K+E

for your file of practical information on drafting and reproduction from

KEUFFEL & ESSER CO.

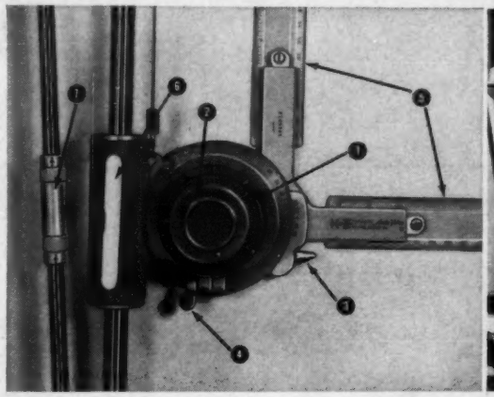
Anything you can do with a drafting machine you can do almost as well with a T-square, triangle and protractor. It just takes a *lot* longer and it's a *lot* harder. That's why so few drawing boards these days are seen "sans-machine."

Every board – and draftsman behind it – has slightly different requirements. This is why there are PARAGON® Drafting Machines by K&E in a variety of tested styles. Just take your pick:

Whatever your angle . . .

Taking a page out of school . . .

A lot of firms employ chalkboards for group work, demonstration, rough planning, and other forms of "communal" drafting activity. If you've got such a board around your shop, we've got just the machine to fit it. Called the "Chalkboard" AUTO-FLOW this is essentially an AUTO-FLOW with elongated horizontal and vertical tracks and special mounting brackets. Whatever the length or height of your chalkboard, there's a Chalkboard AUTO-FLOW to accommodate it.





1. Full 360° indexing with automatic 15° stops, released at a touch, 2. Contour-designed control knob to match shape and motions of the hand, 3. Thumb-release to set in-between angles, 4. Base-line release – located near protractor head for fastest operation, 5. Easily-adjusted, interchangeable scales, 6. Conveniently placed finger-tip brake control to lock or release vertical position, 7. Convenient horizontal motion brake for one-hand operation, sitting or standing.

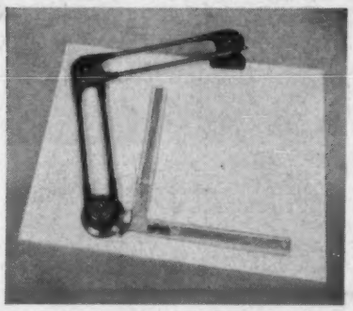
The PARAGON AUTO-FLOW® Drafting Machine is tops – by far the most versatile drafting machine to come along in years. A track-type machine with a wealth of work-saving features, the AUTO-FLOW can simplify your whole drafting operation. The board angle *you* find most convenient will suit the AUTO-FLOW to a "T." And no irksome counterbalance weights or friction brakes are necessary. A quick adjustment of a tension spring wheel puts the AUTO-FLOW in perfect balance – vertically, or anywhere down to the horizontal. The AUTO-FLOW's scales can be moved quickly and locked firmly into *any* position on the board. Both horizontal and vertical motion brakes are designed for rapid, one-hand operation. Smooth, *full-board* action lets you draw straight lines the entire length and width of the board in one continuous motion – something it's impossible to do with conventional machines. And – the *piece de resistance* – the AUTO-FLOW's superbly functional designs puts *all* controls conveniently on, or adjacent to the control head for the easiest operation ever. This engineered control system considerably reduces the number of arm and hand motions needed to produce a finished drawing.

An old dog with new tricks . . .

If you prefer the conventional, "elbow-armed" drafting machine, the PARAGON standard is just your dish. You'll find plenty of refinements here, too. This is *one* "elbow-armed" machine that won't creep or crawl on the board. Just a twist of a thumb screw adjusts for perfect arm balance at any board angle up to 10°. The arms themselves *never* need adjusting. Tension bands are factory-set for years of use. Scales always lie snug and flat on the board and both arms twist freely in either direction. They can be lifted over objects on the board and returned to the same setting with ease. Baselines can be changed instantly, too. A convenient release lets you establish a new baseline in seconds, while maintaining your "0" setting on the protractor. And the PARAGON standard has essentially the same engineered control head that so many swear by on the PARAGON AUTO-FLOW – the biggest time-saver in drafting since paper.

For the sometime user . . .

Maybe you're a design engineer, a chief draftsman, an ex-draftsman "keeping his hand in," or any one of many having only occasional need for a drafting machine. If so, the PARAGON Jr.® (shown below) is your mate. Originally designed for desk use by students, the PARAGON Jr. is ideal for the "part-time" draftsman. Patterned after the PARAGON standard, this compact drafting machine offers all the important features found in its full-sized counterpart, *plus* the convenience of "tuck-away" dimensions. Its combination mounting bracket permits temporary or permanent mounting on almost any desk, board, or table. It will operate efficiently at any board angle up to 25° and will accept any scales with standard chuck plates. Its engineered control head has full 360° indexing with automatic 15° stops, a convenient lock-lever for intermediate settings, and a rapid release for full 360° base-line adjustment while retaining "0" indexing.



And that's the lot – a PARAGON, we hope, for everyone. If the ease and speed of "feather-touch" drafting has a place in your operation, simply fill out and mail the coupon below and we'll show you how the PARAGON of your choice delivers it – like no other drafting machine can.

KEUFFEL & ESSER CO., Dept. DN-6 Hoboken, N. J.

Gentlemen:

Please send me complete information on the K&E PARAGON Drafting Machine(s) indicated:

- ☐ K&E PARAGON AUTO-FLOW Drafting Machine
- ☐ K&E PARAGON standard Drafting Machine
- ☐ K&E PARAGON Chalkboard AUTO-FLOW Drafting Machine
- ☐ K&E PARAGON Jr. Drafting Machine

Name & Address: _____

Company & Title: _____ 4065

Circle 32 on Reader-Service Card for more information

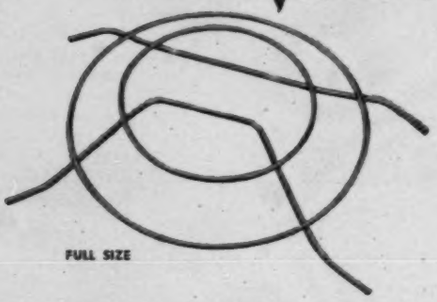
made of
WIRE?



It is! This heavy duty switch handle was formed by Titchener from ⅜" coiled steel wire.

FULL SIZE

Here's the other end of the scale, a small lamp guard made of .047" round steel wire. Electric-welded construction — two rings and two legs.



FULL SIZE

Our facilities for automatically forming wire components and welding wire assemblies can solve problems, save money. All sizes of wire from ⅜" to .047"— many metals, finishes, too. Engineering consultation is available for the asking.

FREE *design handbook*

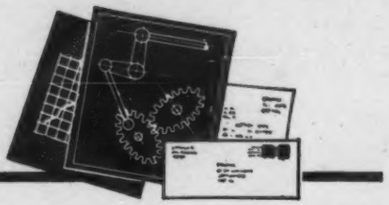


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E. H. **Titchener**
AND COMPANY
64 CLINTON STREET, BINGHAMTON, NEW YORK

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IDEA MART
DESIGN NEWS



AVAILABLE

'Hydraulic Cartridge'

Purpose of this device is to provide a leakproof method of force transmission without use of seals. As shown in Fig. 1, the cylinder is formed of 12 segments which surround a closed cartridge in the center. Purpose of the segments is to provide the equivalent of milled slots without space between each segment. A sheet of shim stock approximately 0.005 inch thick may be wrapped around the cartridge under the segment. Because the cartridge is sealed with entrapped fluid, pressure applied by a plunger-set screw will force each segment to move radially outward. This action provides a grip on any surrounding object such as grinding wheel, gear hob or milling cutter. The device may be accurately ground to provide exact diameter needed for a particular mounting problem so that an increase in diameter of only a few thousandths of an inch will be required to provide sufficient grip. Fig. 2 shows the surrounding cylinder as a corrugated or fluted design. Write IM 516, Idea Mart, DESIGN NEWS, 3375 S. Bannock St., Englewood, Colo.

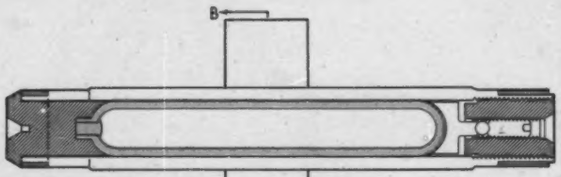
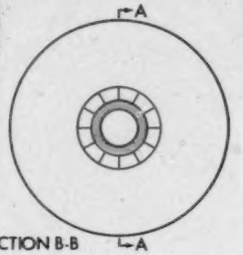


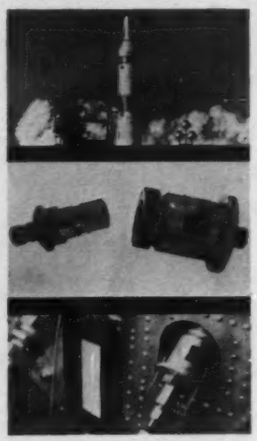
Fig. 1



Fig. 2



COLD TEMP PROBLEM
ON MARK KNOW-HOW = **PROVEN PRODUCTION MISSILE HARDWARE**



PROBLEM: *3000 P.S.I. gaseous helium to seal @ −270° to −320°*
Zero leakage during fill (connected)
50 lb. min. to 100 lb. max. Breakaway Force
Zero leakage after disconnect (both socket and adapter)

KNOW-HOW: *ON MARK (1127 Series) Quick Disconnect Coupling, specifically designed for the ultimate in reliability @ temperatures from −270° to −420°*

SOLUTION: *Proven Production Missile Hardware in Action!*

4440 York Boulevard, Los Angeles 41, California — On Mark — *CLinton 4-2501*

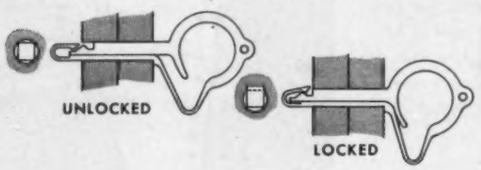
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Ideas described in this department are in various stages of development and may be at any point from "initial concept" to "patented".

AVAILABLE

Quick-Release, Self-Locking Shear Pin

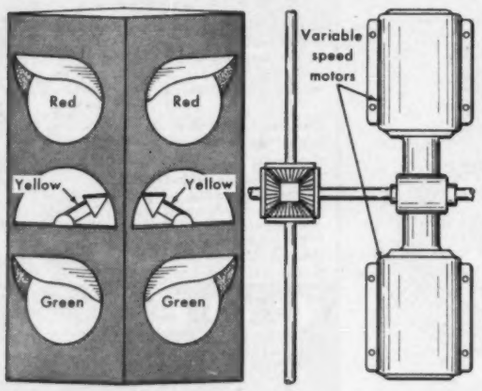
This one-piece fastener may be made of extruded, molded or machined nylon, or of metal for high-strength applications. The fastener is inserted in a prepared hole and pushed into the locked position. One portion of the fastener slides on a second portion and a resilient finger is expanded into a detent. The unit is in the lock position because the cross-section of the fastener is larger than the hole. A pull on the fastener will allow the resilient finger to escape the detent and return to its normal position so the pin can be removed. Cutting of the fasteners from an extrusion will provide several sizes for different applications. Wish to sell or license. Write IM 517, Idea Mart, DESIGN NEWS, 3375 S. Bannock St., Englewood, Colo.



Traffic-Control Device

This device indicates elapsed time and remaining time of traffic-light intervals. A lighted yellow arrow is positioned between customary red and green lights. When the red light comes on, the arrow revolves in a clockwise direction, covering 180 deg during the interval. When the red light changes to green, the arrow reverses and revolves 180 deg counterclockwise.

Because intervals of red and green are usually different, speed of rotation must vary in the two cycles. While a number of mechanical or electrical arrangements would suffice, a simple arrangement uses two small motors which turn a gear arrangement operating four shafts. Wish to sell or license. Write IM 509, Idea Mart, DESIGN NEWS, 3375 S. Bannock St., Englewood, Colo.

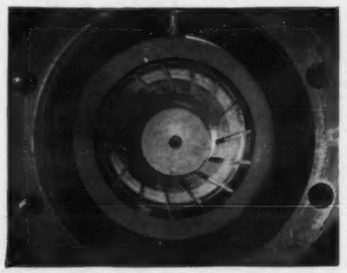


frenchtown engineered ceramics NEWS MEMO

FRENCHTOWN PORCELAIN COMPANY • FRENCHTOWN, NEW JERSEY

Frenchtown rebuilds hydraulic pump with own material

Isostatic forming of alumina ceramics requires intermittent application of medium and high pressures in a pump's hydraulic chamber. This severe service condition often leads to pump trouble. And at Frenchtown, it was no exception. Running at 1200 rpm, vane type rotary pumps delivered 12 gallons per minute at 400 psi. The chatter of vanes under extreme operating conditions resulted in self-destruction with an average service life of less than 700 hours between failures. Standard practice was to return the pump to the manufacturer for renovation. Taking full advantage of the extreme hardness, ability to take diamond polish and great mechanical strength of high alumina ceramics, Frenchtown replaced the steel liner rings with Almanox® 4462. The first unit thus rebuilt has been operating 80 hours a week for over two years, at a speed of 1800



rpm, and at an output of 18 gpm without any perceptible wear. As a matter of fact, the diamond grinding marks are still visible, and the vanes have become burnished to a high finish and hardness. The cost of rebuilding each pump is less than one-third of the unit exchange price.

Why not investigate how Frenchtown engineered ceramics can make your product better? A blueprint or sketch with specifications will bring complete information.

Frenchtown 787 Beryllium Oxide Body offers unique engineering material

Combining excellent electrical properties with high thermal conductivity, Frenchtown 787 beryllium oxide material is available in molded and extruded shapes.

Frenchtown's Molcote® metallized coating may be applied to selected areas for subsequent assembly with metal parts through brazing or high-temperature soldering. Nickel, copper, gold and other plated metals are applied over the Molcote® as specified.

Demand for Frenchtown 787 beryllium oxide as semi-conductor packages indicates a widespread acceptance of this material for use where heat-sink function is coupled to that of electrical insulator. Nuclear instruments and control apparatus also make extensive use of the material's unique properties.

Write for your personal copy of the property chart shown below, as well as details on other Frenchtown engineered ceramics. No obligation.

PROPERTY		UNIT	VALUE
Physical			
Type of body			90% Beryllium Oxide
Color			White
True Specific Gravity			2.95
Bulk Specific Gravity			2.81
Weight		Lb./cu. in.	.106
Pore Volume		Percent	4.74
Water Absorption		Percent	None
Thermal			
Maximum Use Temperature		Degrees F	2750
		Degrees C	1510
Linear Coefficient of Expansion x 10^{-6}	25-100 C		3.45
	25-400 C		6.62
	25-700 C		7.78
Thermal Conductivity Cal/sec/cm²/cm/C		at 100 C	.323
Mechanical			
Compressive Strength		Lb./sq. in.	200,000
Flexural Strength		Lb./sq. in.	27,000
Resistance to Impact (Charpy)		In. lb.	5.5
Hardness (Mohs Scale)			8
(Rockwell 45N)			50
Electrical			
Dielectric Strength		Volts/mil	220
Dielectric Constant at 1 mc			6.26
Power Factor at 1 mc			.00042
Loss Factor at 1 mc			.0026
Te Value		Degrees F	2220
		Degrees C	1215
Volume Resistivity at	200 C	Megohms per Centimeter Cube	
	300 C		
	400 C		
	500 C		370.0
	600 C		160.0
	700 C		80.0
	800 C		38.0
	900 C		12.7
	1000 C		4.3
	1100 C		1.1

Circle 35 on Reader-Service Card for more information



FLEXIBLE SHAFTS

the secret of Ford's swing-away wheel

The secret of the new swing-away steering wheel in the Ford Thunderbird is a flexible shaft between the stub shaft in the steering gear box and the upper steering rod.

Here are the benefits derived from flexible shafts:

1. *Safety*. Safety against failures is provided.

2. *Durability*. Flexible shafts eliminate the possibility of play or lost motion at this juncture for the life of the car.

3. *Compact*. The flexible shaft is more compact than conventional joints.

4. *Strength*. In case of power steering failure, the maximum torque would be 660 pound-inches, which would occur during parking on dry pavement. The flexible shaft can absorb this and *much more*.

Here is another example of creative engineering with flexible shafts. Investigate for yourself how they can solve many of your design problems and at the same time reduce costs.

S. S. WHITE INDUSTRIAL DIVISION,
DEPT. D 10 East 40th Street, N. Y. 17, N. Y.

THE S. S. WHITE FLEXIBLE SHAFT HANDBOOK
New 4th Edition... Send for your free copy!



S.S.White
FIRST NAME
IN FLEXIBLE SHAFTS

1164

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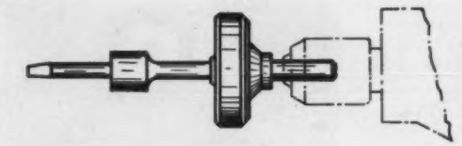
PATENTS

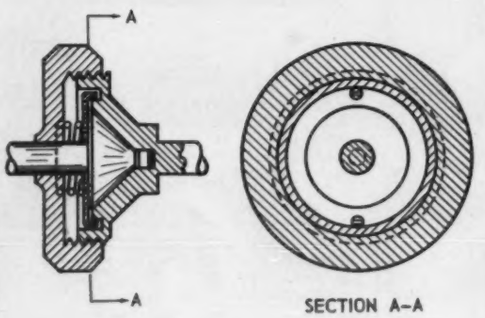
Torque-Limiting Device

U.S. Patent 2,974,503; Alan R. Newton, New Bedford, Mass.

This torque-limiting device, designed for rotary tools, can be chuck-mounted and adjusted to increase or decrease torque transmitted. The chucking shaft is connected with an integral member containing a conical opening, the axis of which coincides with the axis of the shaft. Inner end of the conical opening is formed with a cylindrical opening. The opposite end of the conical opening contains a circular rim, externally threaded. A cone, which fits into the conical opening, is held in position by a combination of compression spring and adjustable element which threads over the rim threads of the chuck-mounted element. An antifriction plate is placed between the base of the cone and the end of the spring and is held in position by lugs which engage depressions in the rim. To prevent lateral wear and to preserve concentricity of the cone, a thrust bearing is formed at the apex of the cone for engagement within the cylindrical opening.

The antifriction ring may be made of brass, bronze, nylon or similar plastics, or may be of pressed and sintered powdered metal to provide an oil-impregnated structure. The adjusting member may be turned relative to the chuck-mounted portion to compress the spring and force the surface of the cone against the surface of the conical opening.





SECTION A–A

When you build new machines or rebuild old equipment you can **SAVE** MATERIAL, TIME, LABOR, MONEY with

COES MICRO-WEAR STRIPS



Master scraping plate at Norton Company with Micro-Wear Strips.

Micro-Wear Strips Applied to the cross slide on the knee of a milling machine.

These are just two of the many applications that help reduce the manufacturers' original cost.

These strips are uniformly hardened to minimum 64 Rockwell C hardness and can be manufactured to your exact specifications, ready for application with Coes #945 Epoxybond adhesive or with holes for hold-down screws.

Send for latest technical information



COES KNIFE COMPANY
71 COES ST.
WORCESTER, MASS.

COES MICRO GROUND

Circle 37 on Reader-Service Card

The following list compiled from recent issues of the Patent Gazette gives you increased coverage of new patents whose details may be useful to product and machine designers. Copies may be obtained from the U. S. Commissioner of Patents, Washington, D. C. The price is 25c each.

VARIABLE-SPEED POWER-TRANSMISSION MECHANISMS
U S Patent 2,981,063; Axel C. Wickman, Miami Beach, Fla.

UNIVERSAL JOINT
U S Patent 2,981,084; Earl W. Glover, assignor to General Motors Corp., Detroit, Mich.

HYDRAULIC LOAD CELL
U S Patent 2,981,101; Leon E. Buck, assignor to Winget, Ltd., Rochester, Kent, England.

SHEET-METAL PULLEY WITH DRAWN HUB
U S Patent 2,981,120; Edward H. Schultz, Jr., assignor to The Nagel-Chase Mfg. Co., Chicago, Ill.

RECIPROCATING VARIABLE-DELIVERY PUMP
U S Patent 2,981,198; Frederick Nettel, Manhasset, N. Y.

FLUID FLOW METERS
U S Patent 2,981,240; Robert E. Nelson, Rosamond, Calif., and George E. Tench, said Tench assignor to said Nelson.

PILOT-OPERATED VALVE MECHANISM
U S Patent 2,981,287; Joseph H. Caslow, assignor to American Brake Shoe Co., New York, N. Y.

GEAR DRIVE
U S Patent 2,981,373; Cornelius W. Van Ranst, Dearborn, Mich.

HYDRAULIC BRAKING APPARATUS
U S Patent 2,981,380; Oswald E. Lessly, La Puente, Calif.

RATCHET MECHANISM
U S Patent 2,981,389; Luther E. Kilness, assignor to The New Britain Machine Co.

THERMOSTAT VALVE
U S Patent 2,981,477; Clarence P. Salmon, assignor to Flexonics Corp., Maywood, Ill.

MOTION-TRANSMITTING DEVICE
U S Patent 2,981,515; Edward F. Abrams and Alexander Silver, assignors to The Garrett Corp., Los Angeles, Calif.

MOTION-CONVERSION DEVICE
U S Patent 2,981,571; Jack E. Martens, assignor to The Anderson Co.

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LAYOUT See file 166-A

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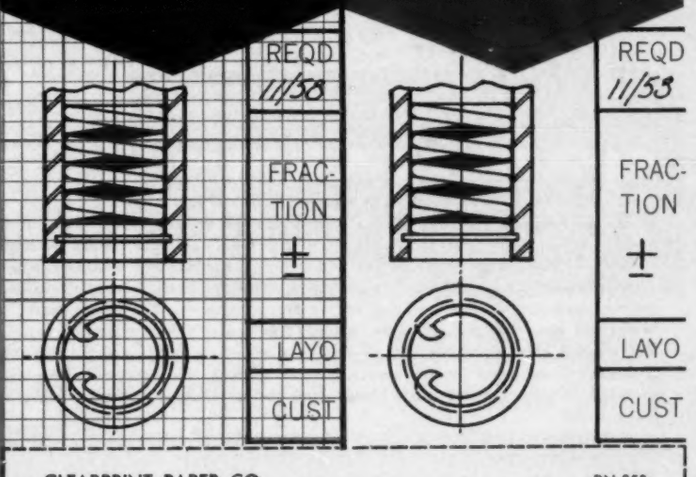
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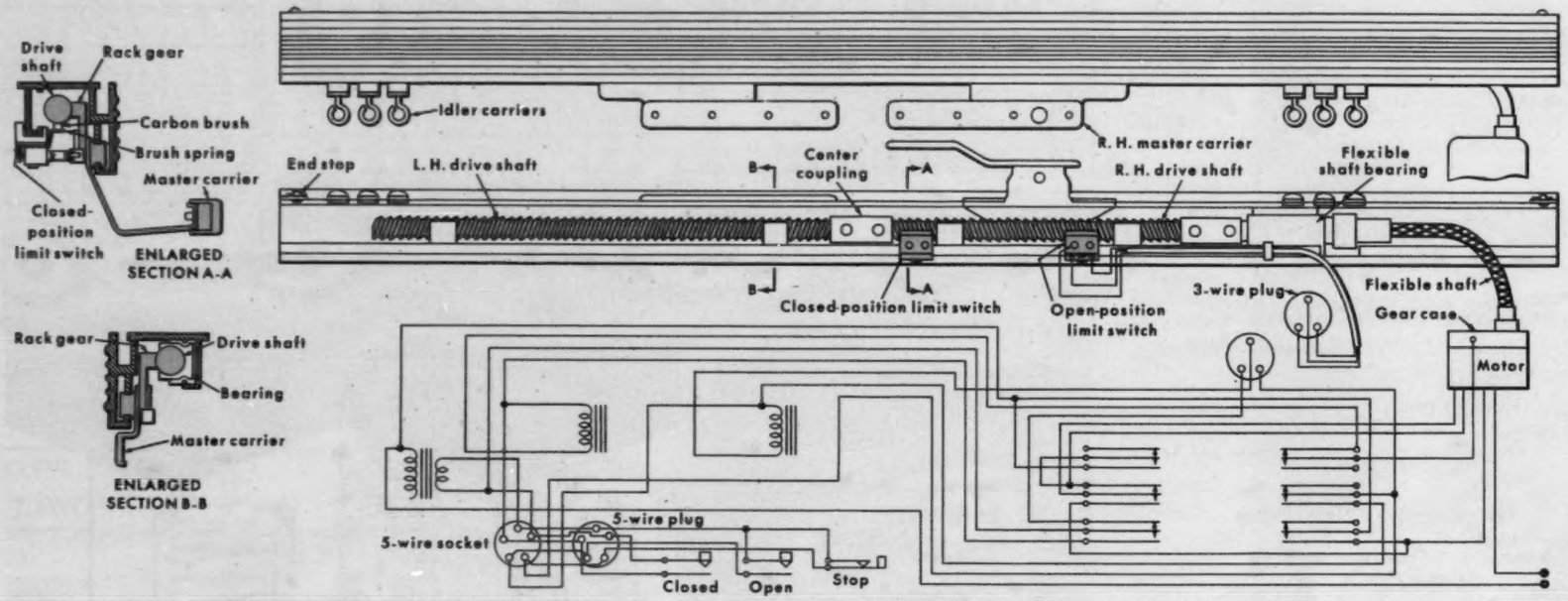
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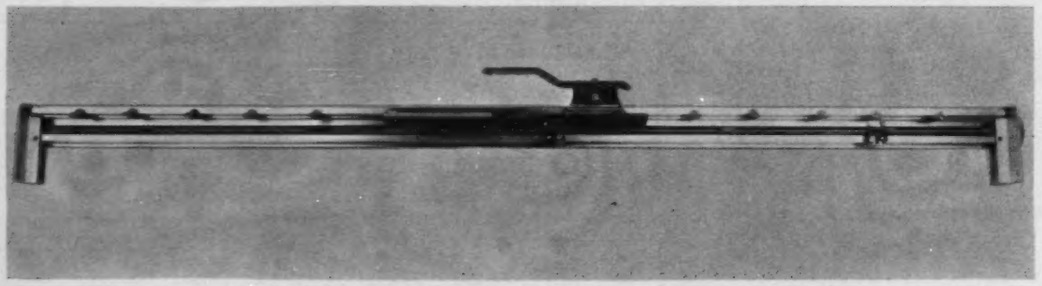
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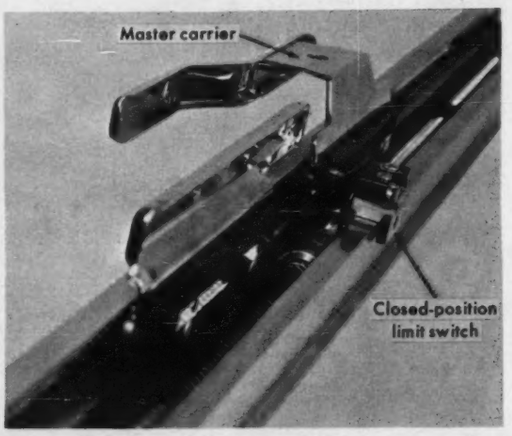
Drive Screw Doubles as Electrical Conductor

Victor W. Wigotsky, Eastern Editor



WITH DRAPERIES IN OPEN POSITION, pressing "close" pushbutton operates relay in series with stop switch and "closed-position" limit switch (N.C.). Latter in turn is connected back in circuitry through drive shaft, shaft coupling, flexible shaft, ferrule and coupling nut to die-cast gear case. Motor and gear case are electrically isolated from outer case, and flexible shaft coupling, nut and ferrule are elctrically grounded to an inner flexible sheath. Overall flexible shaft assembly is then covered with black vinyl jacket. Carbon brush is connected to one side of "closed-position" limit switch through mounting spring. Other side of limit switch connects to track through its mounting bracket. Circuit then returns through track to "open-position" limit switch at which point track is connected to wire. Circuit then proceeds through wire and back to power supply. Once in operation, circuit is maintained until "closed-position" limit switch is opened by action of cam on master carrier which operates on switch roller to break circuit.





RIGHT- AND LEFT-HAND DRIVE SHAFTS are joined by center coupling. Entire control system is 24v plugged in on a five-wire cable. Systems, in turn, may be operated in multiple and connected into a master system which controls up to six individual rods with individual controls located as desired.

A new traverse rod uses the driving screw as an electrical conductor. This eliminates the necessity of running wires to a "closed-position" limit switch at the center of the rod mechanism.

The rod is an integrated unit which includes a low-voltage remote-control system for regulating drapery position along any desired length of track. Since the track could run to considerable length, it was desirable to eliminate wires running to the limit switch at the center point. This was accomplished by using the aluminum drive screw and the track as electrical conductors in the circuit.

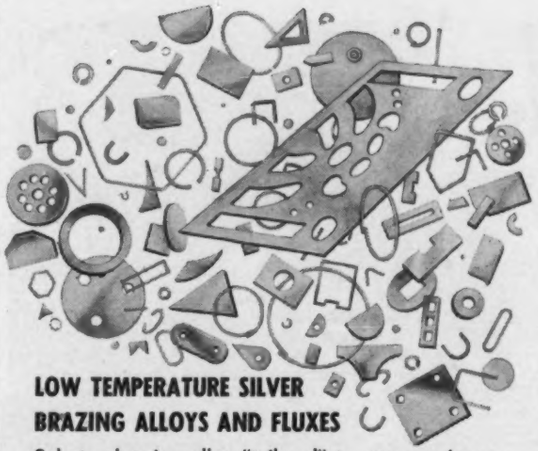
The "closed-position" switch carries a carbon brush which contacts the shaft, while the opposite terminal of the switch is grounded to the extruded aluminum track. This provides a circuit from the motor without need for wiring to the switch. The circuit is maintained until a cam on the drapery's master carrier operates on the limit-switch roller to break contact.

Another problem was to provide a satisfactory bearing system for any length of screw shaft, while still permitting passage along the screw of a rack on the master carrier. A bearing design was developed which included more than 50 percent of the shaft, yet permitted access of the rack gear to the shaft's threaded portion. These bearings are used each 6 inches of track length to support the drive shaft.

Also, a suitable right-angle drive between the motor and drive shaft was desired, which would not require precise alignment or lubrication. This was accomplished with a flexible shaft permanently mounted to the track and attached to the power supply with a retaining nut. The simple drive method eliminates need for exact placement of the power supply.

Since it was desired to limit required horsepower, to reduce size and cost, a low coefficient of friction was required. A special nylon ("Nylartron GS-31") was selected for the bearings and rack gears to provide the low friction coefficient and to permit molding to close dimensional tolerances. The bearing and drive system is sufficiently free of friction to permit a 50-ft section of track to be turned easily by hand in its assembly.

The integrated electric traverse rod was designed by the Electric Traverse Rod Co., Warwick, R. I., an affiliate of Kenney Mfg. Co.



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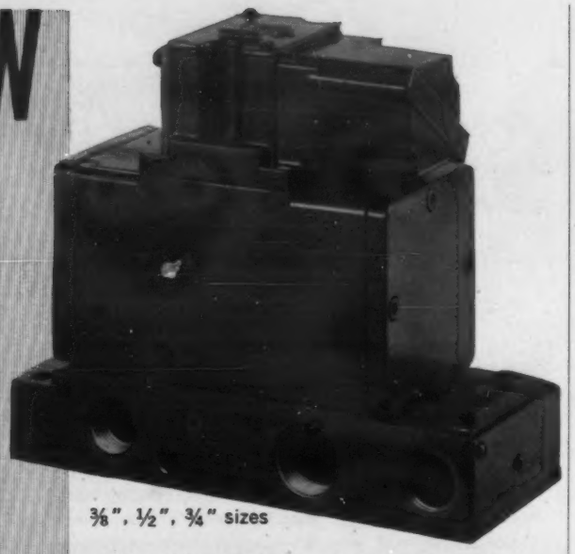
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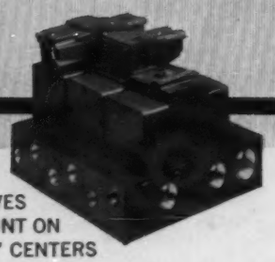
3/8", 1/2", 3/4" sizes

ALL the features you want in 4-way, pilot-operated air control

HOW FAST? So fast it fills 12 cu. in. test chambers from 0 to 90 psi in 0.029 seconds. Larger, 100 cu. in. chambers fill in 0.075 seconds. Valve itself has been cycled on test over 3,000 times a minute. We know of no faster valve.

HOW SURE? Valve will operate on severely restricted air supplies and at pressures down to 15 psi, thanks to a reserve volume of pilot air, maintained at maximum line pressure in a self-restoring accumulator chamber (patent applied for). Low-wattage, nylon encapsulated, plug-in solenoids are guaranteed for life against burnout. New "Comb-O-Seals"—one-piece, pressure-energized—seal positively, cannot be improperly assembled. Any of today's varied air line lubricants can be used. Both pilot valve and main valves operate on poppet principle, cannot stick in dirty air.

HOW GOOD? Good for millions of leak-proof cycles! All-aluminum, die cast construction gives you light weight, assures clean, smooth air passages. Base mounting—all connections, air and electrical, are permanently made to the base. Quick plug-in feature —entire operating unit "plugs" into base; remove two screws and it lifts off easily and quickly. Locking manual over-ride is standard on all solenoid models. All models fully meet J.I.C. standards.



VALVES MOUNT ON 3 1/8" CENTERS

ADD-A-FOLD BASES (optional) permit joining a number of valves together, with one supply, one exhaust, one gallery for electrical connections.

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Air Column in Hollow Shaft

E. J. Stefanides, Central States Editor

A hollow motor shaft in a submersible sump pump acts as a passage for the air column which activates the automatic pressure-sensitive switch. When the outside water level rises to a height of approximately 8 inches, the pressure transmitted to the diaphragm closes the switch contacts to start the pump. When the pump has dropped the water level to approximately 1 inch above the base of the pump, the pressure is relieved sufficiently to allow the spring-loaded diaphragm to open the contacts.

This type of switch eliminates the external complications involved with the use of float-actuated switches and helps to achieve the overall design objective of a completely self-contained pump. A special check valve has been designed which can be slipped into the rubber base. It eliminates the need for an external-line check valve to prevent back-siphoning through the discharge piping.

The motor windings and automatic pressure-sensitive switch are protected by corrosion-resistant molded synthetic-rubber covers and a stainless-steel outer shell and inner liner, which completely isolates these parts from the water in which the pump is immersed.

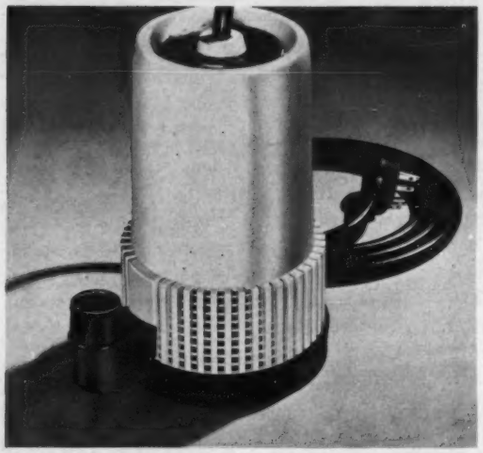
The rotor is protected by a stainless-steel "can" to provide maximum corrosion protection. It is mounted on a hollow shaft which rotates in self-lubricating graphite bearings. The sealless design with self-lubricating bearings eliminates shaft-seal maintenance.

This pump and check valve were designed and manufactured by the Fostoria Corp., Fostoria, Ohio.

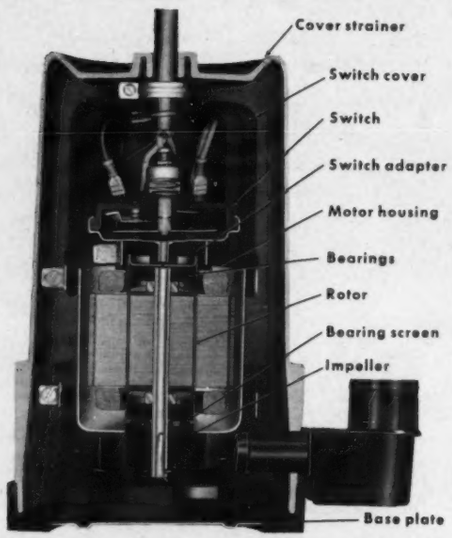


CHECK VALVE consists of extruded rubber flapper housed in injection-molded plastic housing. Housing is equipped with threads on one end suitable for connection to plastic pipe or standard hose; other end is contoured to slip securely into synthetic-rubber base plate. Check valve prevents back-siphoning of water through discharge pipe when pump shuts off.

Activates Switch

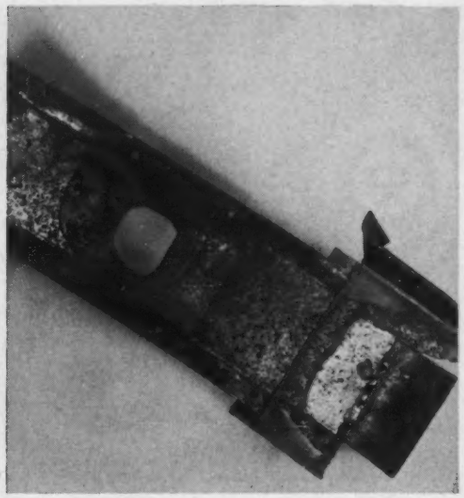


SUBMERSIBLE SUMP PUMP is designed for residential sump drainage service. Pump is self-contained, sealless design, which eliminates shaft-seal maintenance and need for lubrication. It can be used against discharge heads as high as 10 ft. Capacities range from 200 to 700 gph.



CROSS-SECTION THROUGH PUMP showing sealless design. Entire pump is housed in molded polyethylene housing which also serves as strainer. Motor windings and pressure switch are sealed in watertight synthetic-rubber and stainless-steel outer shell. Rotor is sealed in stainless-steel "can" and has hollow shaft to allow transmission of pressure to actuating switch. To prevent sump sediment from being drawn into pump, it has side intake and solid stainless-steel bottom plate.





175° F. sand, being blown to storage, regularly wore through special abrasion-resistant alloy steel wear plates at duct elbows in only 2 months.



Abrasive sand finally gnawed through ADIPRENE® urethane rubber liner in elbows – but it took 6 months.

Foundry finds ADIPRENE® outwears steel 3 to 1

This interesting application shows dramatically how tough ADIPRENE urethane rubber really is. And designers are finding that this outstanding abrasion resistance . . . plus excellent load bearing capacity and low temperature resistance . . . is the solution to many design problems.

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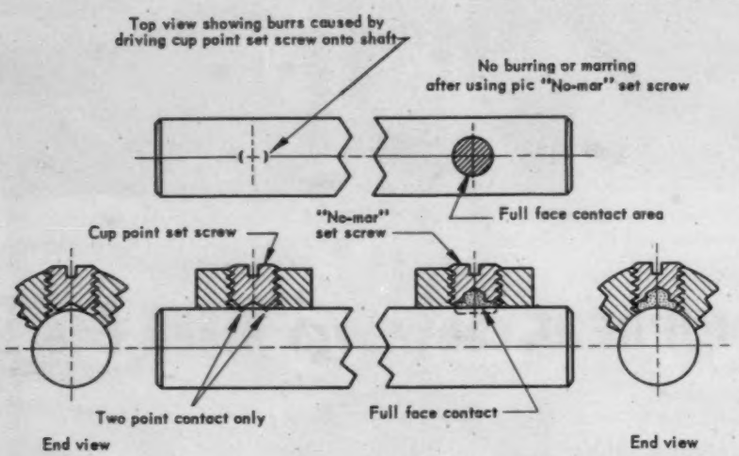
NEW PRODUCTS

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Nylon-Insert Set Screw

301

Prevents Burrs on Precision-Instrument Shafts



This fastener is designed specifically for securing precision-instrument gears, couplings, pulleys, cams, hand cranks and knobs to small-diameter shafts without raising burrs on the shafts. Diameter sizes of shafts with which precision-instrument components are used are generally ⅛, 3/16 or ¼ inch. Shaft-to-component insertion is a sensitive finger-push fit with a 0.0001- to 0.0005-inch clearance. Presence of a burr will obviously cause interference that will preclude disassembly without damage to one or both parts. The "No-Mar" set screw has a hole drilled in the bottom and a small cylindrical nylon insert is fitted into the hole. The insert extends a fraction of an inch beyond the set screw.

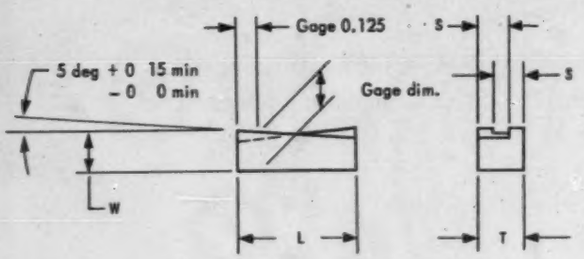
When screw is tightened, nylon mushrooms out and forms a cushion between set screw and shaft. At the same time, it is forced into the thread of the component and locks the screw. The nylon expands slightly in service, further locking in the set screw. The fastener is readily backed out when desired and the shaft remains unmarred. Stainless-steel screws are manufactured with slotted or socket heads in sizes 2-56, 4-40, 6-23, 8-32, 10-24, 10-32 and ¼-20.

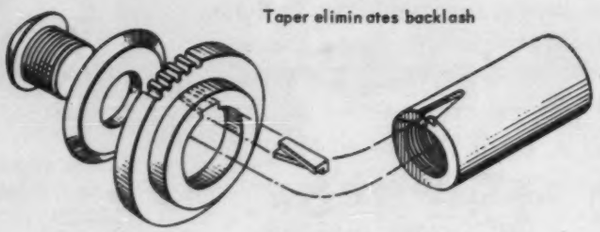
PIC Design Corp., 477 Atlantic Ave., East Rockaway, L.I., N.Y.

Lock Key

302

Eliminates Backlash





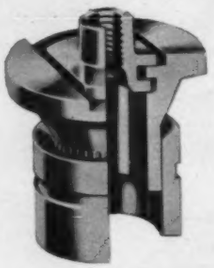
In many devices such as servo-drives in the field of automation and machine tools where clockwise and counterclockwise rotation is involved, it is becoming increasingly important that the backlash or relative rational movement between gear and shaft be eliminated. The "Double Taper Lock Key" utilizes a key having lateral bearing surfaces of opposite longitudinal slope whereby a wedging action is obtained between key and shaft and key and gear, eliminating any possible backlash or relative rotational movement between shaft and gear. These bearing surfaces align the gear axially upon the shaft, removing the necessity of providing a shoulder or similar retaining means.

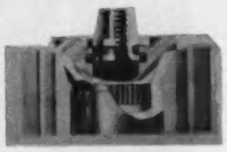
Sure-Lok Co., 7701 Melita Ave., North Hollywood, Calif.

Floating-Lock Fastener

303

Allows for Total Misalignment of 1/16 Inch





A structural floating locknut for honeycomb or sandwich-type panels combines a floating-nut element with a structural-type panel fastener. Simple installation procedures eliminate need for intricate hole patterns and secondary riveting operations. Floating action of the Series 700 fastener allows for total misalignment of 1/16 inch. One straight drilled-through hole prepares panel for fastener installation. Hand arbor press or any ram-type equipment can be used to expand fastener within the core area, enabling loads to be distributed to both cover sheets. The fastening device is available for ¼-inch panels and up, in sizes from 8-32 to ¼-28. Body section can be purchased in aluminum, carbon or stainless steel.

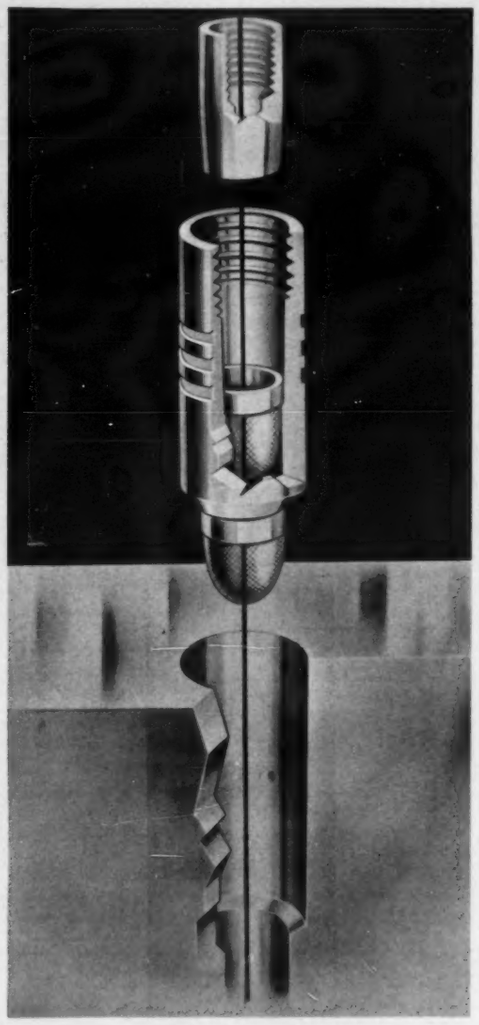
Delron Co., Inc., 5224 Southern Ave., South Gate, Calif.

Fixed Filter Elements 304

Restrict and Regulate Fluid Flow

Quick and easy installation of filter jets eliminates costly assemblies, seals, threads, flow testing and filter design. Each unit contains a calibrated orifice, two matched filters (for either direction of flow) and a locking and sealing device. The device is a cylindrical plug with a tapered reamed hole part way through its center and with small grooves on its outside surface. Laboratory tests report no leaks under normal pressures, with dry seals up to pressures of 40,000 psi. The unit is available in aluminum and steel and in both long and short series.

Lee Co., Westbrook, Conn.





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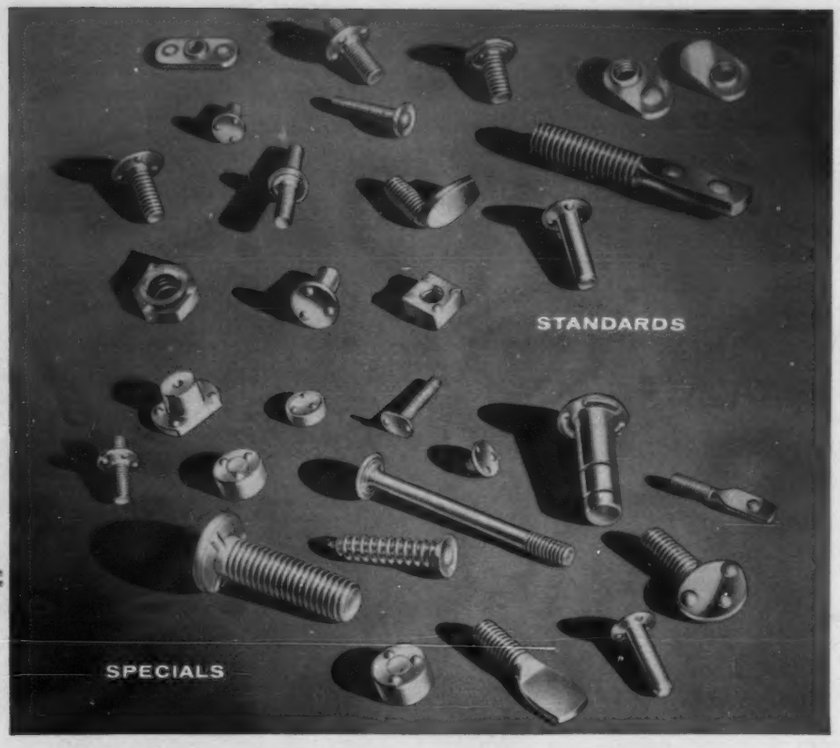
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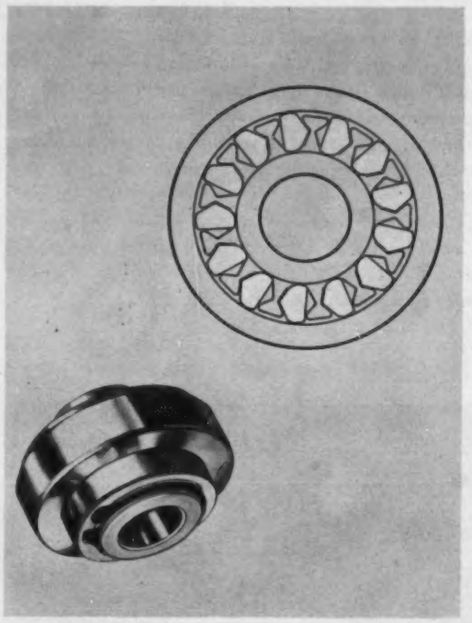
National PRODUCTS

The National Screw & Mfg. Company · Cleveland 4, Ohio

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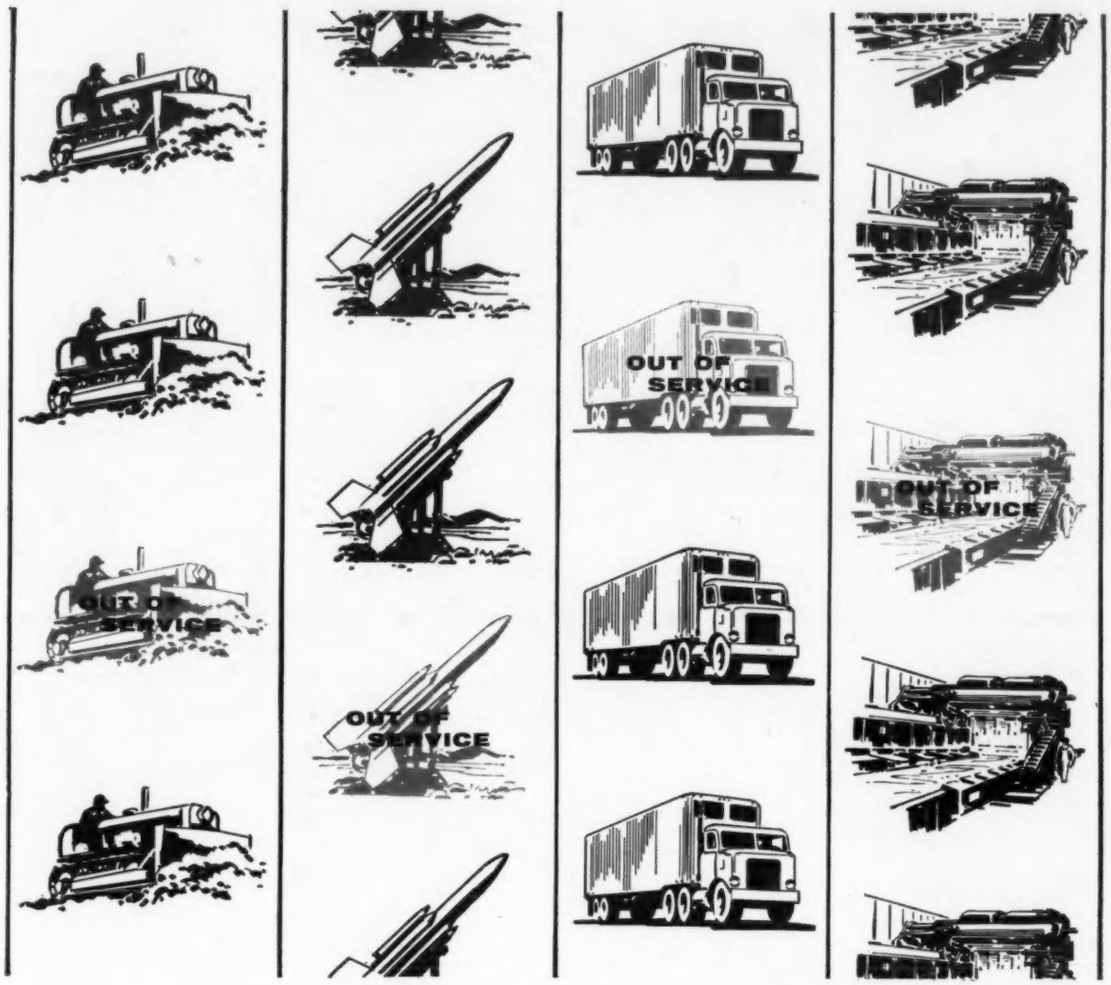
General-Purpose Clutches 305



ARRANGEMENT of separately contoured, individual-leaf springs, one outstanding design feature of newly developed FS-02 and FS-04 miniature-sized sprag-type clutches for a wide range of overrunning and indexing applications in industry, is shown in this cross-sectional diagram. Individual control of sprag-energizing enables the new units to meet ultrahigh-performance overrunning and indexing requirements of a growing number of miniature mechanisms.

Reflecting the trend toward space-saving compactness, simplified construction and miniaturization of essential mechanical components, FS-02 and FS-04 clutches are designed to meet today's stepped-up performance requirements in a wide range of overrunning and indexing applications resulting from the rapidly increasing use of miniature components. Model FS-02 provides 4.5 lb-ft torque and is available with 0.250-inch bore. The FS-04 has 17 lb-ft torque capacity and is offered in bore sizes of 0.375 and 0.500 inch. Both models are designed for high continuous overrunning speeds up to 3450 rpm on Model FS-02 and 2400 rpm on the FS-04. They also are capable of indexing at rates up to 5000 cpm, representing a gain of approximately 15 percent in performance capability above indexing rates previously obtainable with earlier models.

Formsprag Co., 23601 Hoover Rd., Warren, Mich.



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That's why it pays to call in Rollway. Especially when reliability is a must.

At Rollway, you can choose from a wide selection of sizes and types with maximum capacities . . . for normal, low or high temperature operation. All meeting or exceeding RBEC requisites in Classes 1 to 5.

You'll find that Rollway meets your needs exactly – in commercial grade, precision, or ultra-precision bearings. To get the bearing you want in a hurry, or to start R and D on the bearing you've been dreaming about, just call or write Rollway Bearing Company, Inc., Syracuse 1, New York.



Where So Much Depends on So Little . . . You can depend on

ROLLWAY BEARINGS

Radial and Thrust Cylindrical Roller Bearings

ENGINEERING OFFICES: Syracuse • Boston • Chicago • Detroit • Toronto • Pittsburgh • Cleveland • Seattle • Houston • Philadelphia • LosAngeles • SanFrancisco

Circle 43 on Reader-Service Card for more information

Post-Forming: New Way to Bigger Savings with Malleable Castings

The ductility of Malleable iron castings permits use of high-speed forming techniques to finish Malleable parts at lower cost. Take advantage of the versatility you get only with ferritic and pearlitic Malleable castings. For a fuller understanding of how Malleable can help you, call any producer that displays this symbol —



Free Folder describing these techniques is available for your use. Just ask any member of the Malleable Castings Council for Data Unit No. 116, or write to Malleable Castings Council, Union Commerce Building, Cleveland 14, Ohio.

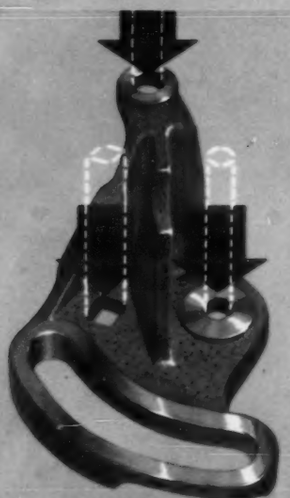
MEMBER
MALLEABLE
CASTINGS COUNCIL



Hot Form It — Hot coining this Malleable transmission part reduces finished cost . . . eliminates three cutting operations required by the previously used steel part.



Roll It — Oil grooves in lawnmower crankshafts and splines in compressor crankshafts are just two of many places where rolling proves more economical than machining.



Punch It — Holes with diameters greater than the thickness of the metal can be punched in Malleable. Two round holes and a square hole are punched simultaneously in this idler arm.



Spin It — Malleable's ductility permits the sleeve and end disc in this ball joint to be held in place by spinning the Malleable housing into a strong, permanent flange.

Get the most for your metals dollar...get MALLEABLE

CONNECTICUT
Connecticut Mall. Castings Co., New Haven 6
Eastern Malleable Iron Co., Naugatuck

DELAWARE
Eastern Malleable Iron Co., Wilmington 99

ILLINOIS
Central Fdry. Div., Gen. Motors, Danville
Chicago Malleable Castings Co., Chicago 43
Moline Iron Works, Moline
Moline Malleable Iron Co., St. Charles
National Mall. and Steel Castings Co., Cicero 50
Peoria Malleable Castings Co., Peoria 1
Wagner Castings Company, Decatur

INDIANA
Albion Malleable Iron Company, Muncie Division, Muncie
Link-Belt Company, Indianapolis 6
National Mall. & Steel Castings Co., Indianapolis 22

IOWA
Iowa Malleable Iron Co., Fairfield

MASSACHUSETTS
Belcher Malleable Iron Co., Easton

MICHIGAN
Albion Malleable Iron Co., Albion
Auto Specialties Mfg. Co., Saint Joseph
Cadillac Malleable Iron Co., Cadillac
Central Fdry. Div., Gen. Motors, Saginaw

MINNESOTA
Northern Malleable Iron Co., St. Paul 6

MISSISSIPPI
Mississippi Malleable Iron Co., Meridian

NEW HAMPSHIRE
Laconia Malleable Iron Co., Laconia

NEW YORK
Acme Steel & Mall. Iron Works, Buffalo 7
Frazer & Jones Company Division, Eastern Malleable Iron Co., Solvay
Oriskany Malleable Iron Co., Inc., Oriskany
Westmoreland Mall. Iron Co., Westmoreland

OHIO
American Malleable Castings Co., Marion
Central Fdry. Div., Gen. Motors, Defiance
Dayton Mall. Iron Co., Ironton Div., Ironton
Dayton Mall. Iron Co., Ohio Mall. Div., Columbus 16
National Mall. and Steel Castings Co., Cleveland 6

PENNSYLVANIA
Buck Iron Company, Inc., Philadelphia 22
Erie Malleable Iron Co., Erie
Lancaster Malleable Castings Co., Lancaster
Lehigh Foundries Company, Easton
Meadville Malleable Iron Co., Meadville
Pennsylvania Malleable Iron Corp., Lancaster

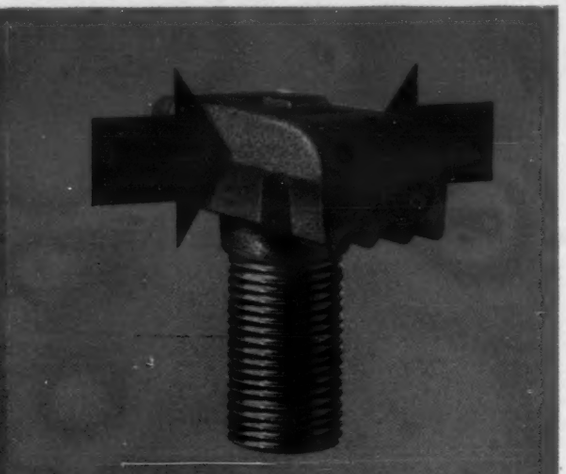
TEXAS
Texas Foundries, Inc., Lufkin

WEST VIRGINIA
West Virginia Mall. Iron Co., Point Pleasant

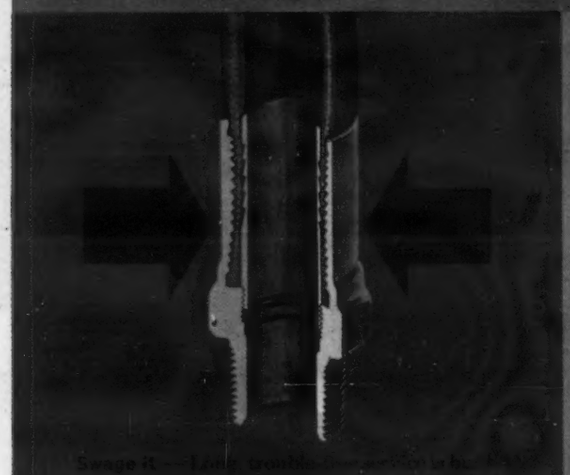
WISCONSIN
Belle City Malleable Iron Co., Racine
Chain Belt Company, Milwaukee 1
Federal Malleable Company, Inc., West Allis 14
Kirsh Foundry Inc., Beaver Dam
Lakeside Malleable Castings Co., Racine
Milwaukee Malleable & Grey Iron Works, Milwaukee 46



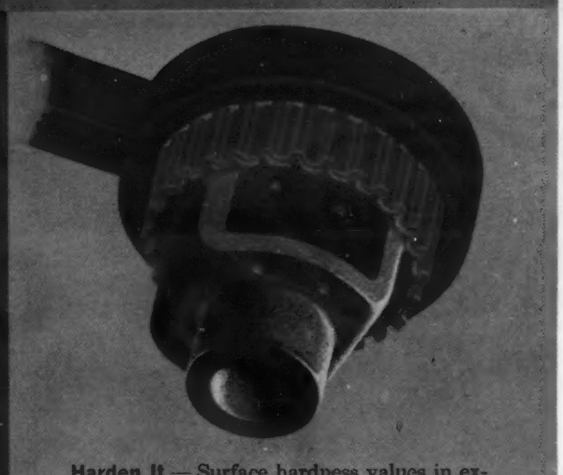
Bend It — A 30% cost reduction was achieved by casting this Malleable iron twine finger flat . . . then bending the arm about 45 degrees and coining the center hub in one fast, post-forming operation.



Coin It — Very close tolerances are often met economically by either cold or hot coining. The head of this T-bolt is coined to meet tolerances of ± .005" on its .475" width without any machining.

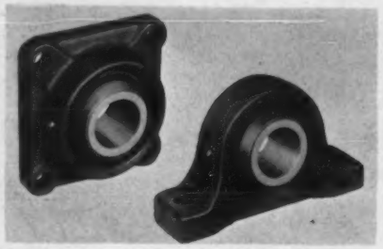


Swage It — Long trouble-free service is built into this high-pressure tube coupling by swaging the Malleable body around the reinforced tube. It's cut, machined and assembled. Working pressure is 6,000 psi.



Harden It — Surface hardness values in excess of 55 Rockwell C can be achieved with pearlitic Malleable by either flame or induction hardening. Response is excellent, and results are uniform.

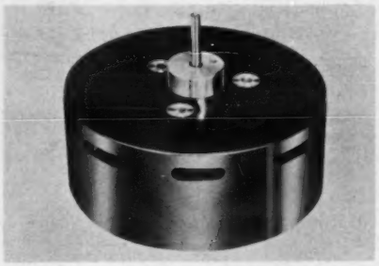
Self-Aligning Bearings 306



Self-lubricating sleeve bearings in flanged and pillow-block types solve many difficult bearing problems. Components are designed to operate in temperatures up to 1000F in corrosive and contaminating conditions, in inaccessible locations where lubrication and maintenance are problems, where noise control is important and at slow speeds or under water. Bearing cartridges are held in position in housing by means of a set screw, which, when backed off, allows cartridge to be rotated 180 deg.

Link-Belt Co., Dept. PR, Prudential Plaza, Chicago 1, Ill.

Synchronous Motors 307



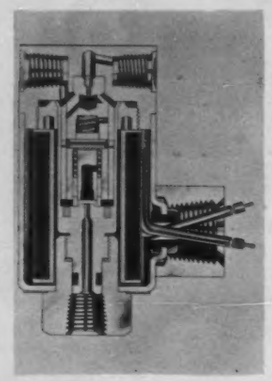
Measuring 2 inches vertical by 4 inches OD (or 5 inches OD, according to model) in seven speeds in 360- to 3600-rpm range, rotary components are offered in single-speed or multispeed models. Single phase is available for 110/120 and 220/240v a-c; three-phase for 220/240v. The device provides high start-run torque characteristics for a given rpm and low induced flutter for capstans, memory drums and pulse generators. Builtin shielding retains stray flux. Shaft runout is available for tape drives within 0.0001-inch TIR. Ambient temperature range is −32 to 135C.

Rotax, Inc., 2209 Federal Ave., Los Angeles 64, Calif.

Circle 44 on Reader-Service Card for more information

MECHANICAL

Subminiature Solenoid Valves 308



The B Series valves are designed for use in hydraulic and pneumatic devices and control systems and operate with all common media including many semicorrosive fluids. Body and operating parts are stainless steel. According to the manufacturer, the valves are smaller than any other standard lines presently available—measuring only 1 inch in dia by 2-1/4 inches high and weighing 5 oz. Orifices are 3/64 inch and fluid connections are all 1/16-inch PTF. Because of the small size, each valve adapts to standard 1/8-inch flared tube. Operating differential pressures run from a vacuum of 5 microns to pressures of 150 psi. Three-way normally closed valves are now available. Coils in most a-c and d-c voltages and frequencies are standard. Housings are offered with choice of grommet or 1/4-inch NPT conduit for electrical connections.

Skinner Electric Valve Div., New Britain, Conn.

Circle 45 for Reader Service



What's your problem? If you can solve it with a

New Cutler-Hammer operator options provide top flexibility... world's best oiltight limit switch

For any use, anywhere, in any position . . . you just can't buy a more reliable, longer-life switch. No other switch is sealed more effectively . . . effectiveness we've proved under test conditions so rugged they will never be equaled in actual service. Even the silver-to-silver contacts are visible for quick inspection. For full details on this complete new line, write for Pub. ED-145-L272.

For any electrical control problem, contact your local Cutler-Hammer sales office or distributor. They'll supply you with the finest electrical components, the finest service and technical help.



Many operator options, many special new features, including four position operator head.

limit switch, your best answer's here!

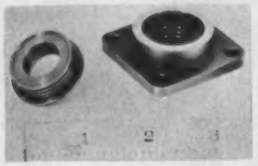
WHAT'S NEW? ASK...

CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wisconsin • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C. A. • Associates: Cutler-Hammer Canada, Ltd.; Cutler-Hammer Mexicana, S. A.

CONTROL

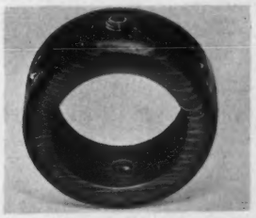
Rotary Face Seal 309



Design of this compact unit features a short, one-piece, precision-machined bellows which is heliarc welded flush to the flange-type mount. A graphite carbon seal is recessed in the housing to accommodate shaft wear ring within the envelope length of seal assembly. Constructed of stainless steel, the assembly is subjected to 2200-psi surge pressures and a normal operating pressure of 5000 psi.

Hydrodyne Corp., 7350 Coldwater Canyon Ave., North Hollywood, Calif.

Split Locking Collars 310



Made from self-lubricating wood, collars can be applied to any existing shafting supported by plain, journal-type bearings. Split feature allows installation in virtually inaccessible areas, eliminating necessity for removing pulleys and gears. The split collar also serves as a thrust surface which eliminates metal-to-metal contact and insures quieter operation.

Paramount Oilless Bearing Co., Inc., 99 Hope Ave., Worcester, Mass.

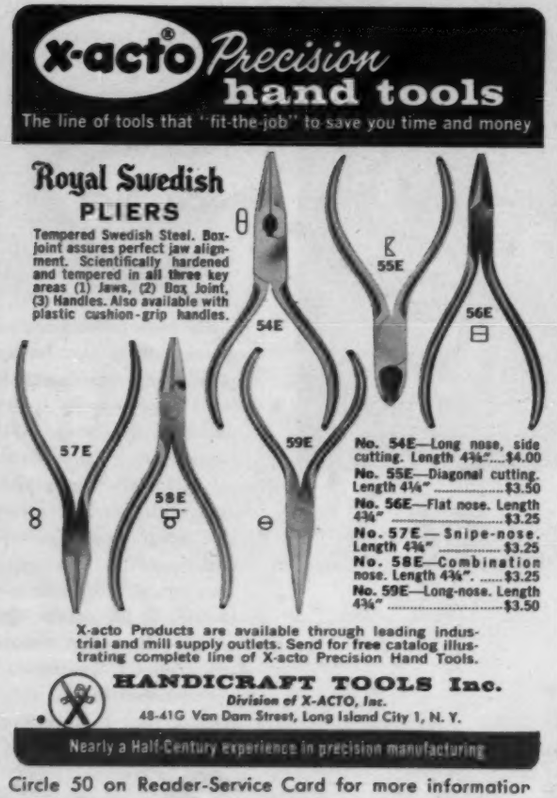
Circle 45 for Reader Service



SQUARE D COMPANY

wherever electricity is distributed and controlled

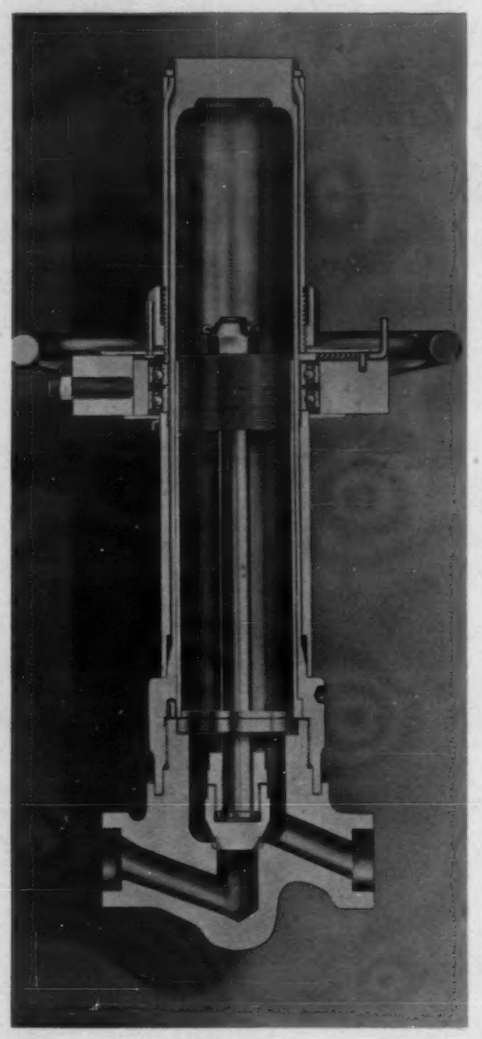
Circle 49 on Reader-Service Card for more information



Circle 50 on Reader-Service Card for more information

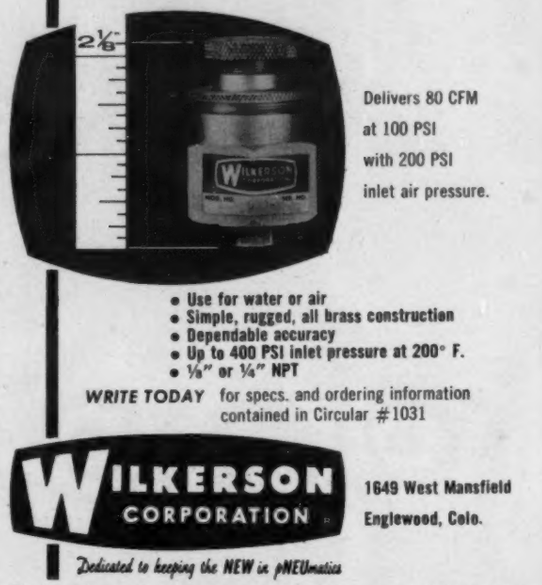
MECHANICAL

Hermetically Sealed Packless Valves 311



High-temperature globe valves incorporate a new method of operation. The principal design advantage offers a hermetically sealed unit with zero leakage to atmosphere, permitting instantaneous changes in setting. The inherently high mechanical advantage provides a high seating force and low operating torque with resultant tight seal. Units are designed for high operating temperatures, with 600F at 2200 psi being the normal rating for pressurized water reactor service. Valves can be made available for manual or motorized operation, with either electric or air-motor drives supplied to specification.

United Shoe Machinery Corp., Harmonic Drive Div., Balch St., Beverly, Mass.



Circle 51 on Reader-Service Card for more information



Circle 52 on Reader-Service Card for more information

Inertially Damped Servomotor 312



This damped, six-pole 400-cycle, Size 15 servo produces a higher torque-to-inertia ratio than normally found in this size. It also features large flywheel damping and very broad frequency response. Pertinent data are: theoretical acceleration at stall, 22,700 radians per sec squared; minimum power output, 1.51w; input power at stall, 6.1w; motor dampening, 130 dyne-CM second. Mechanical specifications are: stall torque, 1.20 oz-in; flywheel inertia, 100 GM-CM squared; flywheel damping, 750 dyne-CM second; weight, 18 oz; temperature range (ambient), −55 to 125C; rotor moment inertia, 3.74 GM-CM; no-load speed, 6200 rpm minimum.

Wright Machinery Co., Div. of Sperry Rand Corp., Durham, N.C.

Circle 53 on Reader-Service Card



CAPLUGS DIVISION, PROTECTIVE CLOSURES CO., INC.
2205 Elmwood Ave., Buffalo 23, N. Y.

MAIL a free assortment of Caplugs, literature and prices to us, without obligation.

Name_____
Title_____
Firm_____
Address_____
City_____ Zone____ State_____

molded of tough, flexible Polyethylene

quickly applied . . . and removed

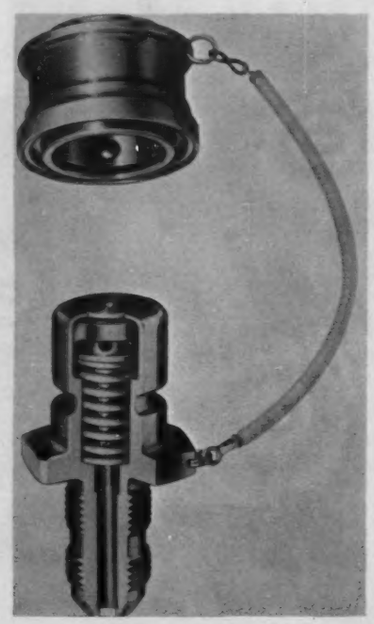
won't chip, break, shred, or collapse

extremely kind to threads

Caplugs

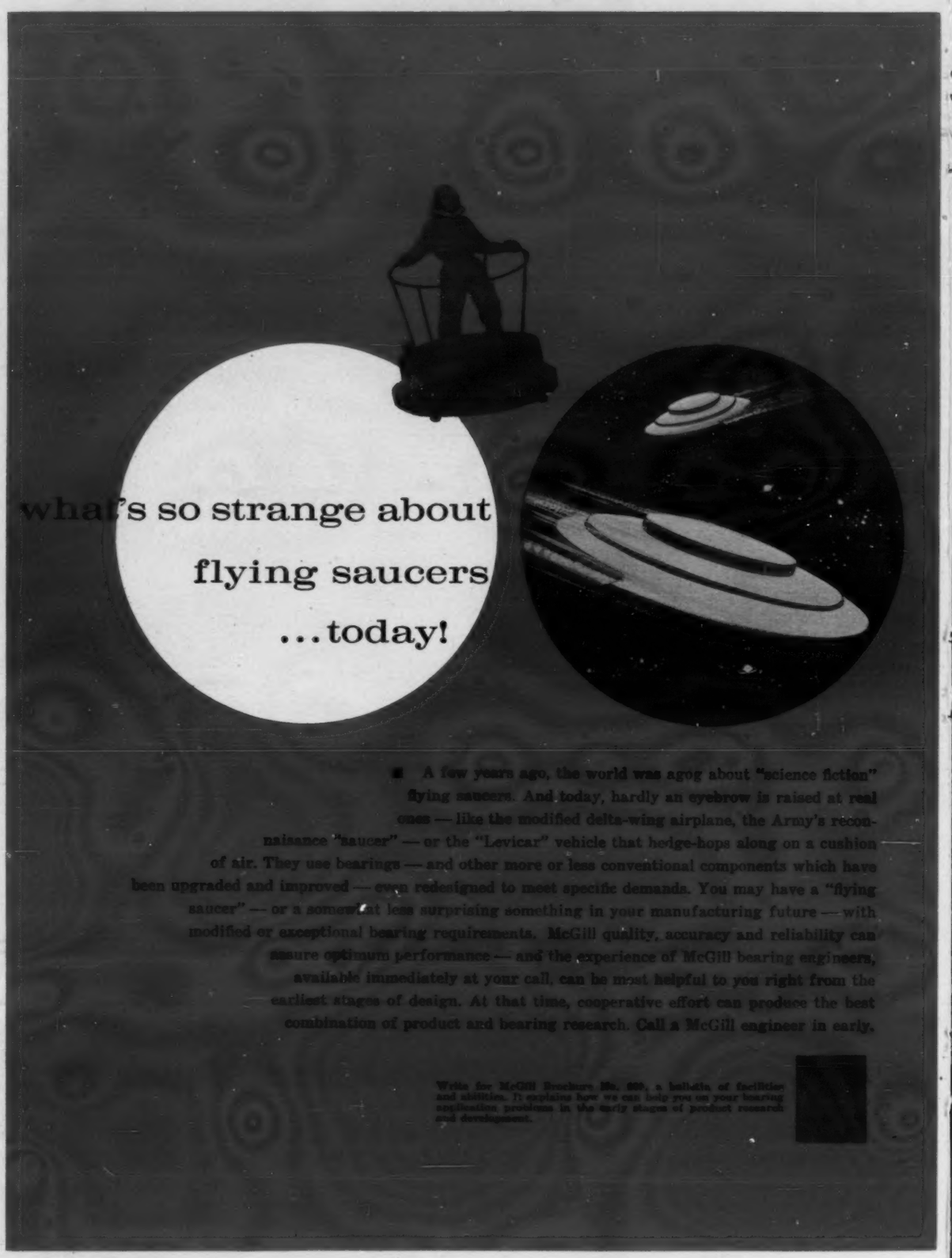
The modern way to protect tubing, threaded fittings and machined parts in storage, process and transit . . . over 600 sizes in numerous styles now in stock.

Quick-Disconnect Adapter And Cap Assembly 313



When the cap assembly of this quick-disconnect is removed, a nozzle connection can be attached to the adapter that will depress the poppet valve and permit oil flow under pressure. When nozzle is removed by quick-disconnect, a spring returns the valve to its closed position immediately, shutting off oil flow and preventing leakage. All metal components are made of stainless steel. The body of the adapter is a one-piece housing spun over poppet valve and spring. A rubber O-ring is seated at the end of poppet to insure a positive seal against leakage. Groove running around the body of the adapter affords a quick-disconnect seat for retaining balls in cap, which are cammed into locked position by outer sleeve of cap assembly. Pressure drop in the unit at a flow of one GPM with MIL-O-7808 synthetic engine oil was only 14 psi for the 1/2 inch tube size and 7 psi for the 3/4-inch tube size. The unit conforms to requirements of MS 24476 Adapter, MS 24480 Cap and MIL-A-25676A.

Dumont Engineering Co., 1401 Freeman Ave., Long Beach, Calif.



A few years ago, the world was agog about "science fiction" flying saucers. And today, hardly an eyebrow is raised at real ones — like the modified delta-wing airplane, the Army's reconnaissance "saucer" — or the "Levicar" vehicle that hedge-hops along on a cushion of air. They use bearings — and other more or less conventional components which have been upgraded and improved — even redesigned to meet specific demands. You may have a "flying saucer" — or a somewhat less surprising something in your manufacturing future — with modified or exceptional bearing requirements. McGill quality, accuracy and reliability can assure optimum performance — and the experience of McGill bearing engineers, available immediately at your call, can be most helpful to you right from the earliest stages of design. At that time, cooperative effort can produce the best combination of product and bearing research. Call a McGill engineer in early.

Write for McGill Brochure No. 800, a bulletin of facilities and abilities. It explains how we can help you on your bearing application problems in the early stages of product research and development.

NEW

CAGEROL®

CAGE TYPE

HEAVY DUTY

NEEDLE ROLLER

BEARING



BY McGILL®

INCREASE EXPECTED LIFE UP TO 10 TIMES!

You need CAGEROL bearing performance if higher speeds and increased misalignment have prevented the utilization of needle bearing load capacity in your applications. Most important, CAGEROL bearings can deliver up to 10 times more expected life where misalignment and increased speeds exceed the capabilities of ordinary and guided needle bearings. The difference is in the exclusive McGill construction that features tapered retainer pockets for balanced roller guidance, crowned rollers, and black oxide retainer finish. CAGEROL bearings are interchangeable with all heavy duty needle roller bearings — with or without inners in two bore sizes.

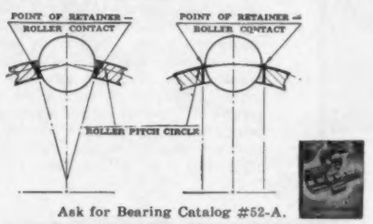
1 Exclusive crowned roller construction, electronically gauged to insure precision contour and size uniformity. Relieved ends assure even load distribution.

2 Flat ends fully engage integral race shoulders, provide maximum support.

3 Proper guidance assured by tapered retainer pockets. The design insures *balanced* roller support and eliminates corner wear from edge loading of straight pockets where retainer OD and pitch circle are coincident.

4 Simultaneously punched pockets assure accuracy of race and roller alignment. The black ferrous oxide retainer finish absorbs and retains lubrication, reducing the friction coefficient.

5 SAE 52100 steel outer race has optimum hardness and surface finish.



Ask for Bearing Catalog #52-A.

engineered electrical products

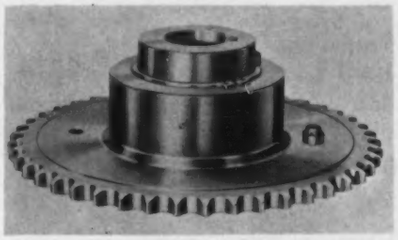
McGILL®

precision needle roller bearings

McGILL MANUFACTURING CO., INC., Bearing Division
203 N. Lafayette Street, Valparaiso, Indiana

Circle 54 on Reader-Service Card for more information

Shear Pin Sprockets 314



Designed to provide positive protection of equipment against destructive overloads, these sprockets are easy to install. The units consist of four basic parts: sprocket, hub, shear pin and retaining ring. As an overload occurs, the pin shears, allowing sprocket to turn freely on hub and disconnecting the drive. All units are furnished completely assembled, ready for placement on the shaft. Their compact design requires only a minimum of space. Extra shear pins also are supplied with each unit.

Chain Belt Co., Milwaukee 1, Wis.

Servomotor and Brake 315



A Size 11 servomotor with an integral friction brake controlled by an electromagnet effectively stops and holds the rotor at a desired position. This prevents the rotor from turning or "creeping" under high vibration or shock. The friction brake is energized by means of a spring. The brake is disengaged, to allow the motor to run, by means of an electromagnet energized by 24v d-c. Braking time is 8 revolutions maximum measured from a no-load speed of 6200 rpm. Motor operates on 115/115v, 400 cycles.

Thomas A. Edison Industries, Div. of McGraw-Edison Co., West Orange, N.J.

Transistor Heat Dissipators 316

Suitable for a variety of sizes and types of power diodes and transistors, these units utilize the principle of radial cooling fins for heat dissipation. They are fabricated from one-piece aluminum-bar stock and contain no welded or brazed joints that would serve as a barrier to thermal transfer. Small size allows them to be mounted integrally on boards with other electronic components. Large dissipating area eliminates necessity of mounting transistors or diodes on separate or isolated plates. Dissipators are available in three basic package sizes with various configurations for suitable mounting of JEDEC case sizes.

U. S. Heat Sink, 637 S. Isis Ave., Inglewood, Calif.

Watertight Indicator Lights 317



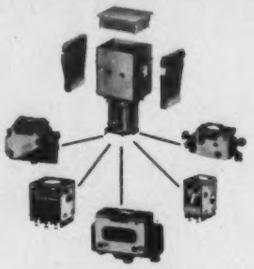
Subminiature indicator lights offer complete watertight integrity on the face of the panel. Watertightness is achieved by means of two 1-1/16 inch-thick neoprene-retained O-ring seals. One O-ring is retained within the back of the lens, the other within the flange of the mounting bushing. Each unit measures 1-3/16 inches in overall length and mounts in a single 15/32-inch clearance hole. Two wide notches on the terminal end of the mounting bushing are centered on terminals, providing greater terminal clearance. Eccentric shape of the terminal location washer enables it to be tightly engaged and locked by the flared-over edges of the notched bushing. The unit accommodates T-1-3/4 midget flanged-base incandescent lamps (MS25237) of voltages ranging from 1.3 to 28.0v.

Dialight Corp., 60 Stewart Ave., Brooklyn 37, N.Y.

Design MICRO SWITCH Reliability Into Your Equipment!



Direct Logic Input Switch generates single square wave output pulse in synchronism with an external clock pulse with each operation. Saves engineering time needed to develop flip-flop and gating networks for synchronizing one-shot circuits. Variations available to fit a wide variety of clock pulse rise times, voltages and frequencies and d-c supply voltages. Write for Data Sheet 172.

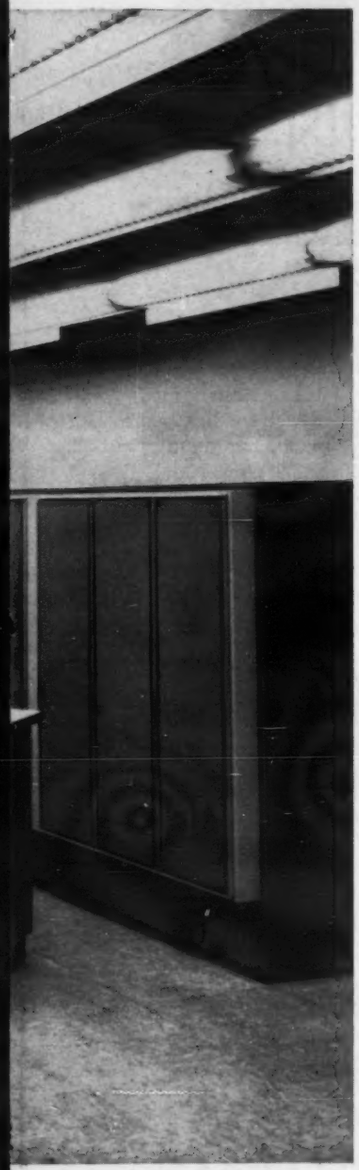


Modular Lighted Push-Button Switches offer customized combinations of eight different basic switches and dozens of colored display screens. Smart styling and enough flexibility to fit your control panel's design exactly. They simply snap together and then snap into your panel —all without tools. Display screens can be engraved. Write for colorful Catalog 67.

Decimal-to-Binary Switch Space-saving answer for computer control panels. Wiring requires fewer connections than wafer-type rotary. Snap-action gold contact, switching elements are enclosed and tamper-proof. Requires only 1.3 square inches of mounting surface on control panel. All operating positions are detented to give the operator positive feel of the switching action. For MICRO SWITCH reliability write for Data Sheet 170.

Door Interlock Switches Used on hazardous equipment cabinets to cut off power when service door is opened. Complete line is available including high-temperature, environment-free and subminiature models. A two-switch model controls two circuits simultaneously. Special design of brackets eliminates dangers of "tying down" that could occur with conventional type interlocks. Write for Data Sheet 186.

MICRO SWITCH Precision Switches



In electronic equipment...

SWITCH RELIABILITY SAFEGUARDS YOUR PRODUCT'S REPUTATION

If you manufacture electronic equipment, remember that the success of your product often depends on a switch. The design of switches for complex electronic applications is a specialty. By specifying MICRO SWITCH Precision Switches you can open new possibilities for automatic control. You can also be sure of precision and reliability that is thoroughly tested in the industry's most complete test laboratory for small and subminiature switches. Find out about the important new switch ideas being added to the MICRO SWITCH line, every one with MICRO SWITCH reliability.

MICRO SWITCH . . . FREEPORT, ILLINOIS
A division of Honeywell
In Canada: Honeywell Controls, Limited, Toronto 17, Ontario

Honeywell
MICRO SWITCH Precision Switches

HONEYWELL INTERNATIONAL
Sales and service offices in all principal cities of the world. Manufacturing in United States, United Kingdom, Canada, Netherlands, Germany, France, Japan.

Circle 55 on Reader-Service Card for more information

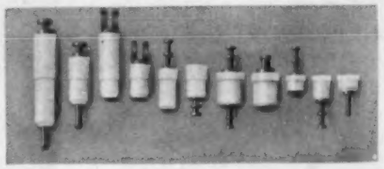
Recording Head Replacement 318



A tape-recording head is a direct replacement for most Wollensak and many other tape recorders produced over the past few years. The 5TR-B is a combination half-track, mono, record/playback and erase head. Eighteen replacement heads comprise the line, including: half-track mono record/playback; quarter-track stereo record/playback heads; half-track stereo erase heads; half-track mono erase heads, and quarter-track stereo erase heads.

Robins Industries Corp., 36-27 Prince St., Flushing 54, N.Y.

'Teflon'-Insulated Terminals 319



Insulated terminals in this line include four new types of press-mount units. Each new type is available in seven configurations with the following insulator diameters: reverse feed-through—0.148 and 0.171 inch; feed-through—0.148, 0.171 and 0.215 inch, reverse standoff—0.148, 0.171 and 0.215 inch, and standoff—0.093, 0.148, 0.171 and 0.215 inch. In series numbers 4000, 4100 and 4200, the terminals are offered in single turret, double turret, combination single and double turret, combination spade and single turret, and in pin types. Utilizing high-impact resistance, temperature stability, dielectric strength and chemical inertness, terminals are available in white "Teflon" with brass terminals as standard.

Cambridge Thermionic Corp., 445 Concord Ave., Cambridge 38, Mass.

Subminiature Potentiometer **320**



The Model 3367, single-turn, wirewound potentiometer is designed for use in printed circuits and other modular-type applications where extreme angular resolution is not required. Specifically, this model fills a gap in the potentiometer market by providing a combination of price and specifications (including the ability to withstand steady-state humidity). Spacing of the printed-circuit pins permits interchangeability of the Model 3367 with other more expensive potentiometers of its type. In addition, Model 3367 is also available with panel-mount bushing and solder-lug terminals. Electrical specifications are: wide range of resistances, 100 to 20K ohms; low nominal resolution, as low as 0.12 percent; high power rating, 0.5w at 70C; and high operating temperature, −55 to 105C. The unit measures 1/2 inch in dia by 0.210 inch and weighs only 0.05 oz.

Bourns, Inc., 6135 Magnolia Ave., Riverside, Calif.

Circle 56 for Reader Service

GRAPHITAR®

(CARBON-GRAPHITE)

FOR PERFORMANCE

Superior performance and unusually long service life, even in tough applications, is practically second nature to parts made of GRAPHITAR. That's because they combine GRAPHITAR's chemical stability, heat resistance, low coefficient of friction, adaptability to self-lubrication, mechanical strength, hardness and light weight. An everyday application of GRAPHITAR that illustrates well its versatility and remarkable performance can be found in the face-type valves employed in bulk station gasoline meters.

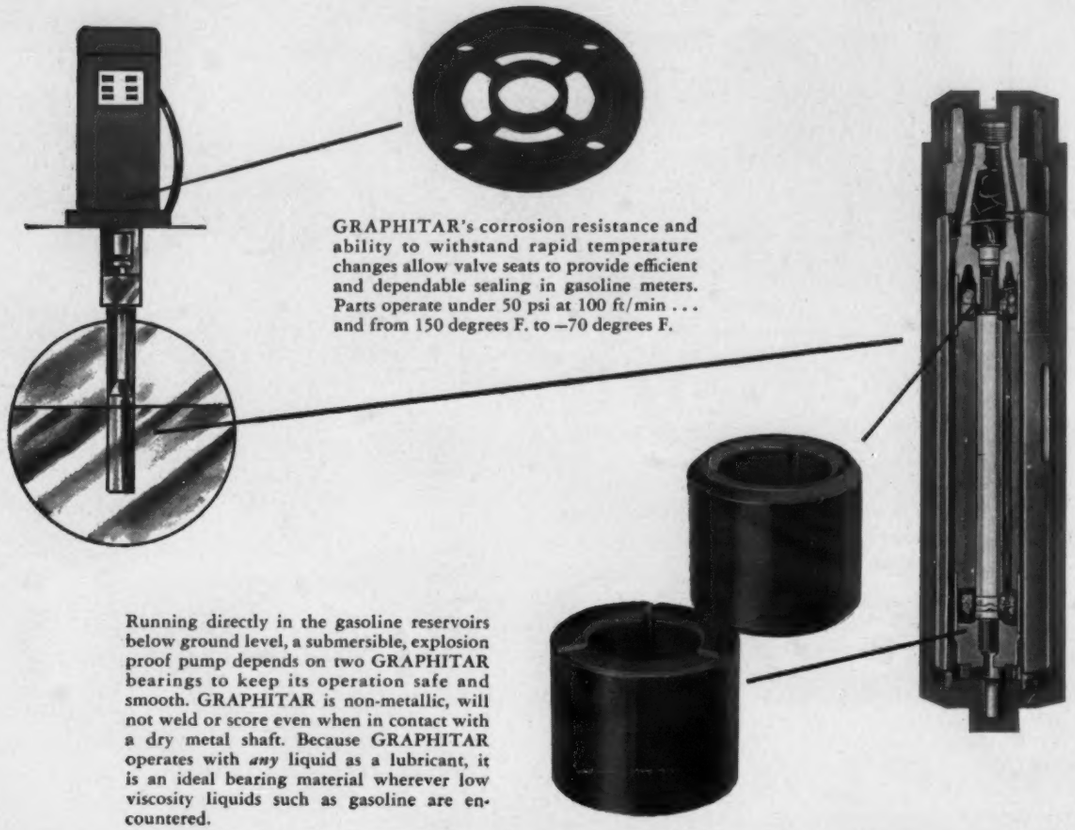
These valves incorporate GRAPHITAR seats. Here, GRAPHITAR's corrosion resistance, chemical inertness and resistance to expansion or contraction under rapid temperature changes, allow the valves to provide a leak-tight seal with excellent wear characteristics. These same characteristics are necessary for good performance wherever steam, gas and chemicals must be handled under the most adverse conditions. Perhaps your product can benefit from the top performance of GRAPHITAR, a unique and versatile engineering material.



Comparative testing of various grades of GRAPHITAR self-aligning seals is accomplished on this equipment, which duplicates actual operating conditions. GRAPHITAR rotary pressure joint seals such as these often operate at 400 psi, at 650°F. and at rotary speeds of 600 ft/min.

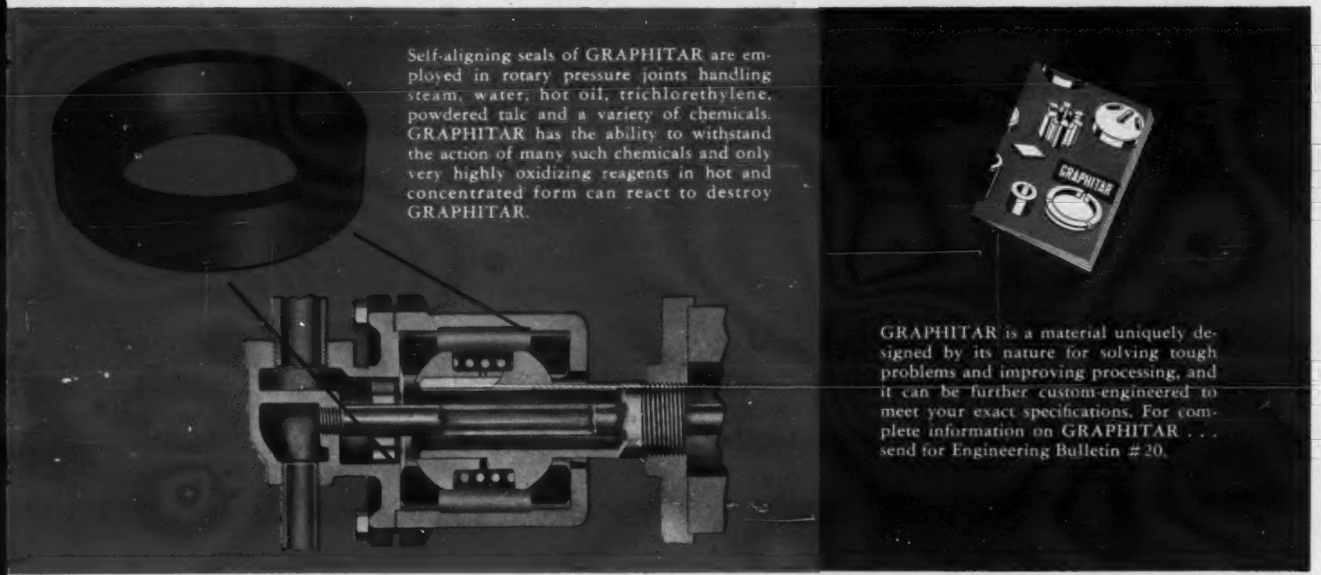


Tests show that the compressive strength of GRAPHITAR grades varies from 4,500 to 45,000 psi. Correct part design can take advantage of this desirable characteristic to aid part performance.



GRAPHITAR's corrosion resistance and ability to withstand rapid temperature changes allow valve seats to provide efficient and dependable sealing in gasoline meters. Parts operate under 50 psi at 100 ft/min . . . and from 150 degrees F. to —70 degrees F.

Running directly in the gasoline reservoirs below ground level, a submersible, explosion proof pump depends on two GRAPHITAR bearings to keep its operation safe and smooth. GRAPHITAR is non-metallic, will not weld or score even when in contact with a dry metal shaft. Because GRAPHITAR operates with *any* liquid as a lubricant, it is an ideal bearing material wherever low viscosity liquids such as gasoline are encountered.



Self-aligning seals of GRAPHITAR are employed in rotary pressure joints handling steam, water, hot oil, trichlorethylene, powdered talc and a variety of chemicals. GRAPHITAR has the ability to withstand the action of many such chemicals and only very highly oxidizing reagents in hot and concentrated form can react to destroy GRAPHITAR.

GRAPHITAR is a material uniquely designed by its nature for solving tough problems and improving processing, and it can be further custom-engineered to meet your exact specifications. For complete information on GRAPHITAR . . . send for Engineering Bulletin #20.

THE UNITED STATES GRAPHITE COMPANY

DIVISION OF THE WICKES CORPORATION, SAGINAW 2, MICHIGAN

GRAPHITAR® CARBON-GRAPHITE • GRAMIX® POWDER METALLURGY • MEXICAN® GRAPHITE PRODUCTS • USG® BRUSHES

R-299-2

3/4-Inch-Square Trimmer 321



A 3/4-inch-square trimming potentiometer (the 25-turn Model 51) is of humidity-proof construction with "Teflon"-insulated leads. Moisture-and immersion-proofing are accomplished by incorporating an internal retainer for the adjusting screw, eliminating one or more openings in the case usually required for this purpose. The adjustment screw is sealed with an O-ring and the disc-shaped cover with an epoxy-covered pressure gasket. Good surface contact between the mandrel and aluminum case allows the unit to dissipate easily its 3w rated power without use of an external heat sink or additional hardware. Dual contact wiper design prevents circuit interruption under the most severe conditions of shock and vibration. The model is available in ranges from 50 to 200K ohms and weighs only 5 grams. It meets or exceeds all applicable military specifications for altitude, fungus, salt spray, humidity, sand and dust, temperature cycling, shock and vibration, and immersion per MIL-STD-202B, Method 104A, Condition A.

Spectrol Electronics Corp., 1704 S. Del Mar Ave., San Gabriel, Calif.

Circle 56 for Reader Service



Shear, form or weld A.W. Super Diamond with standard shop equipment. Pattern matches any angle.

SUPER DIAMOND



Sweep, hose or mop A.W. Super Diamond. Water drains off in all directions. No pockets to hold dirt.

FLOOR PLATE



Reduces slides and slips. Super Diamond puts safe footing on steps, ramps, aisles; aids traction even if wet.



Write for Bulletin SD-51

ALAN WOOD STEEL COMPANY

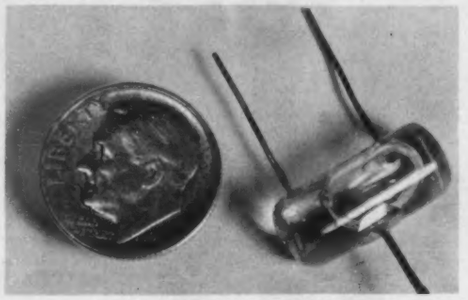
Conshohocken, Pa. • STEEL PRODUCERS WITH THE CUSTOMER IN MIND

DISTRICT OFFICES AND REPRESENTATIVES: Philadelphia • New York • Los Angeles • Boston • Atlanta Cincinnati • Cleveland • Detroit • Houston • Pittsburgh • Richmond • St. Paul • San Francisco • Seattle Montreal, Toronto and Vancouver, Canada: A. C. Leslie & Co., Ltd.

Circle 57 on Reader-Service Card for more information

ELECTRICAL

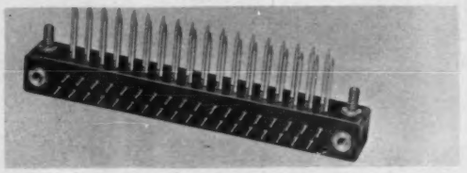
Vertical Sensing Element 328



Designated No. 228571-1, this single-axis electrolytic unit drives torque motors directly without amplifiers. The "on-off" snap-action device cannot be nulled and has a tilt angle of 0.75 deg (plus 30 arc minutes spread from full scale in one direction to full scale in opposite direction). Differential output voltage is 18v and the instrument has 18-ma maximum current through either contact. The element operates between 75 and 135 minutes of arc.

Kearfott Div. of General Precision, Inc., 1150 McBride Ave., Little Falls, N. J.

Wire-Wrap Terminals 329



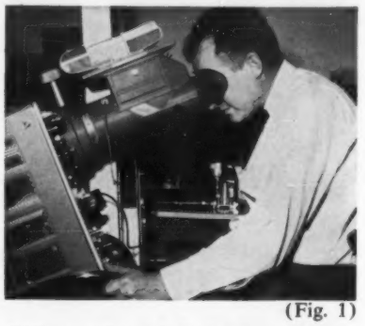
Series 145-50 terminal blocks provide an interconnecting link between printed circuitry and wire-wrap terminations. Three styles provide a choice of mounting studs, through mounting holes, and right-angle pins, mounting studs and threaded inserts. Each model has 36 wire-wrap contacts capable of accepting three or more wires, depending on wire size. Contact material is hard brass, gold plate over silver plate. Mounting hardware is passivated, corrosion-resistant steel. The 4-1/2-inch long body is molded from "Orlon"-filled diallyl phthalate (MIL-M-14F, Type SDI-5). Recommended test voltage at sea level is 3000 rms. Current rating is 7.5 amps maximum. Wire-wrap contacts are spaced 0.200-inch center-to-center; right-angle pins are spaced 0.100 inch. Minimum creepage and air space between contacts is 0.156 inch.

DeJur-Amsco Corp., Electronics Div., 45-01 Northern Blvd., Long Island City 1, N.Y.

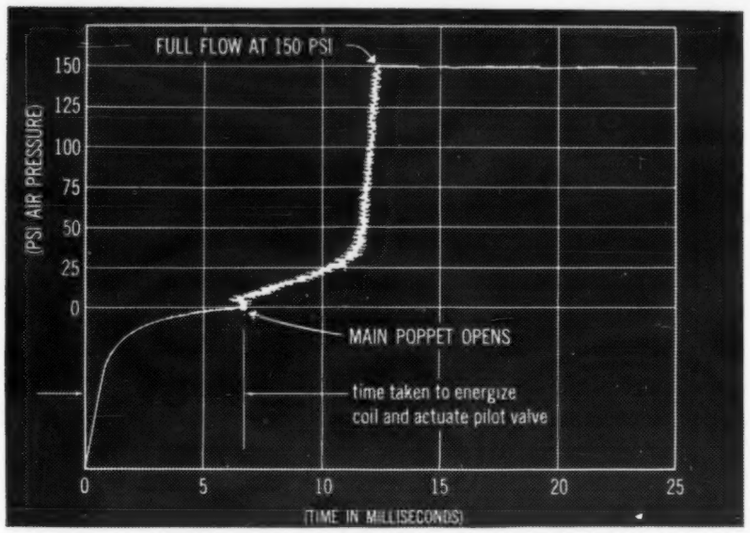
'Mach 2' Air Valve Gives 12 Millisecond Response

Oscilloscope tracks valve action from 0 to full flow at 150 psi

Twelve milliseconds is the time required to energize the solenoid coil, actuate the pilot valve, and bring the main poppet of a "Mach 2" air valve into fully open position at 150 psi. To record the instant response that eliminates lag in air-automated operations, a Crescent® "Mach 2" 4-way air valve was tested by the American Laboratory, Los Angeles, California. A camera located over the oscilloscope screen (Fig. 1) photographed the response action. Tests were made with a 12 volt DC coil in the de-energized position, poppet No. 1 in the closed position, and a system pressure of 150 psi. The graph (Fig. 2) was drawn from a photograph of the oscilloscope screen. The curved line in the lower section of the graph indicates the time required to energize the coil and actuate the pilot valve. The heavier line, above, is the oscilloscope's registration of the increase in pressure as poppet No. 1 moved from closed position to full open position where 150 psi line pressure was reached. Total elapsed time is 12 milliseconds.



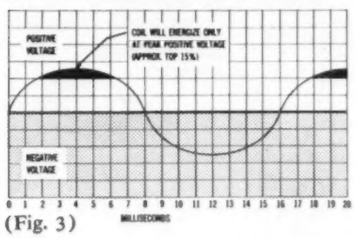
(Fig. 1)



(Fig. 2)

Corresponding results on AC current

Tests were run, also, on AC voltages and identical fast response was registered when coil actuation began at the positive peak of the AC sine wave. As indicated in Fig. 3, a wave length of AC current is approximately 16 milliseconds in duration. A coil will not energize until voltage has reached approximately 85% of capacity. The energized period represents 15% of the sine wave or 4 milliseconds. Therefore, additional milliseconds will be added to response time up to 12 milliseconds if the peak of the sine wave is not caught. Thus, the response time of a "Mach 2" air valve on AC voltage is from 12 to 24 milliseconds. This fast action is positive assurance against lag in operations where instant response is imperative – sorting, counting, discarding sub-weight containers, spot welding, etc.



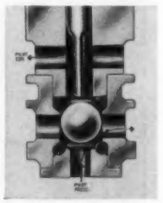
(Fig. 3)

High speed PLUS dependability

The fast response of "Mach 2" air valves is attributable to original design advances that also dramatically improve endurance. These new air valves are rated at 1000 cpm continuous duty, and cycling speeds to 2100 cpm have been maintained for intermittent periods of 20 minutes. Control of coil heating and drastic reduction of friction in the solenoid and pilot valve sections are essential for this kind of performance. The extremely short stroke of the "Mach 2" solenoid plunger (3/32" – approximately the thickness of a nickel) fractions the time the coil is energized; heat generation drops and response is stepped up. Coil life is guaranteed for a minimum of 100 million cycles.

Friction drastically reduced

In the pilot valve, a tiny ball seats on "O" rings at both ends of a pilot cartridge. The ball moves freely, independent of the seals. There is no "O" ring drag on the pilot plunger because it requires no seals; where there is no friction there can be no wear. The main valve seats seal on "O" rings, and metal shoulders take the shock in such a way that the "O" ring seal is merely kissed by the seat in the sealed position. As the rings are only minutely flexed, they do not fatigue or lose their resilience.



PILOT CARTRIDGE

Write for your "Mach 2" catalog

The 12 millisecond response and long service life of "Mach 2" pilot operated air valves are sound recommendations for the installation of these field proven units. They are available in 1/4" to 3/4" pipe sizes. For your "Mach 2" catalog write to Barksdale Valves, 5125 Alcoa Avenue, Los Angeles 58, California.



"Mach 2" 4-Way Valve

Circle 58 on Reader-Service Card for more information

Circle 59 for more information on Enjay Products shown inside

What's News in Rubber...



ENJAY BUTYL HT 10-66 gives this playground mat the ability to withstand years of scuffing and abrasion, repeated impacts and flexing, as well as outdoor weathering.

A NEW RUBBER TO DO THE HARD JOBS!

ENJAY BUTYL HT 10-66

Halogenated for...high heat resistance...covulcanization with other elastomers... low compression set... and faster cures

Plus these well-known Butyl advantages:

- *High flex, tear and abrasion resistance*
- *Low gas and moisture permeability*
- *Excellent chemical resistance*
- *High weather and ozone resistance*

NOW AVAILABLE IN A VARIETY OF MOLECULAR WEIGHTS



AIR-HOLDING INNERLINERS of Enjay Butyl HT 10-66 help assure correct inflation pressure for tubeless tires and can give greater blowout protection as well as improved tire-tread wear. Other tire uses include white sidewalls, black sidewall veneers and chafer strips.

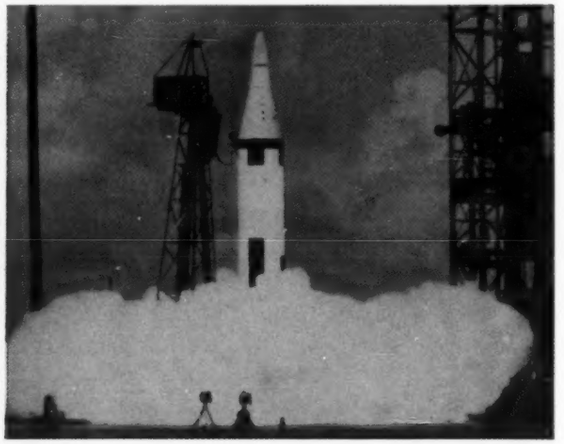


APPLIANCE PARTS of Enjay Butyl HT 10-66 withstand the deteriorating effects of detergents and dishwashing compounds. Absorption of hot water by the rubber is reduced to a minimum.

HOT MATERIAL BELTS like this perform well at continuous temperatures of 350°F, thanks to the exceptional heat aging properties of Enjay Butyl HT 10-66.



SHOCK-RESISTANT LAUNCHING PADS of metal-covered Enjay Butyl HT 10-66 withstand launching shock and exposure to intense heat encountered in missile firings.



WRITE TODAY FOR NEW TECHNICAL MANUAL HT 10-66...

Contains processing information, performance data and recommended cure systems. For your free copy or for technical assistance in applying this important new polymer, write to Enjay, 15 West 51st St., New York 19, N. Y.

ENJAY® BUTYL

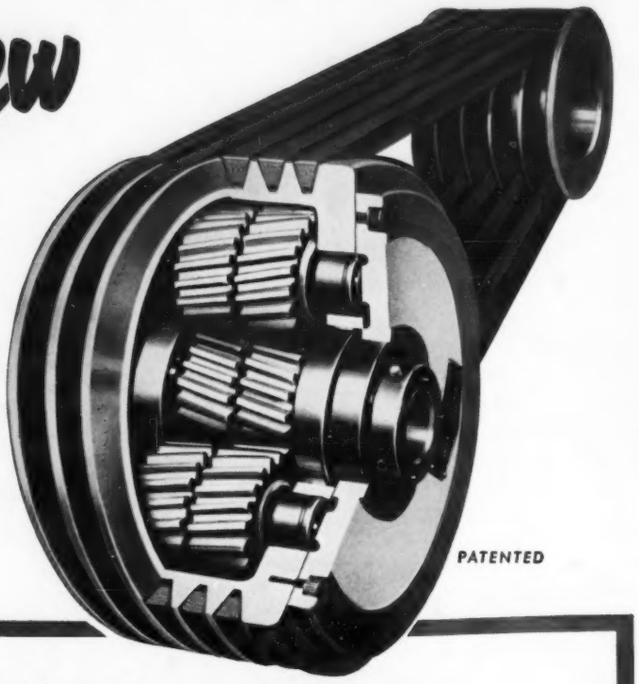
EXCITING NEW PRODUCTS THROUGH PETRO-CHEMISTRY

ENJAY CHEMICAL COMPANY

A DIVISION OF HUMBLE OIL & REFINING COMPANY

New ROTO MISSION®

Most versatile transmission ever developed!



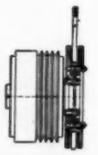
PATENTED

With these standard accessory features



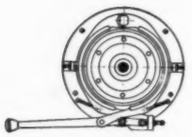
SPRING REACTION ARM

Incorporates a series of leaf springs which provide progressive overload capacity, reduce shock loading, and prevent internal damage to the unit.



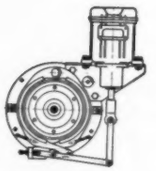
FRICTION REACTION ARM

A spring-loaded friction clutch combined with the reaction arm assembly. Designed to slip at a preselected torsional overload. Restores normal operation automatically when overload ceases.



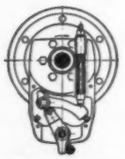
MANUAL FRICTION CLUTCH

Permits manual engagement and disengagement of the unit. Provision is made for adjusting the clutching pressure as well as compensating for wear.



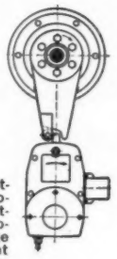
ELECTROMAGNETIC CLUTCH

This modification of the manual friction clutch provides remote control of the unit by means of solenoid actuation.



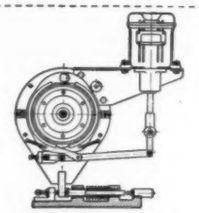
TORQUE RELEASE ASSEMBLY TYPE "A"

A mechanical attachment—integral with reaction arm—which provides complete disengagement when a preselected torque is exceeded.



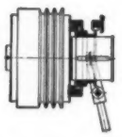
TORQUE RELEASE ASSEMBLY TYPE "B"

A mechanical attachment—separately mounted—which provides complete disengagement when a preselected torque is exceeded.



TORQUE LIMITING CLUTCH

Mechanical modification of the electromagnetic clutch assembly to provide automatic disengagement when a preselected load is exceeded.



DIRECT MESH ATTACHMENT

Permits 2-speed operation through a manually operated clutch mounted on reaction hub.

AIRBORNE®

Engineered Equipment for Aircraft and Industry

AIRBORNE ACCESSORIES CORPORATION

HILLSIDE 5, NEW JERSEY • Offices in Los Angeles and Dallas

For complete information, write for Catalog IR-61 or contact our nearest office

Circle 60 on Reader-Service Card for more information

Circle 59 for more information on Enjay Products shown inside

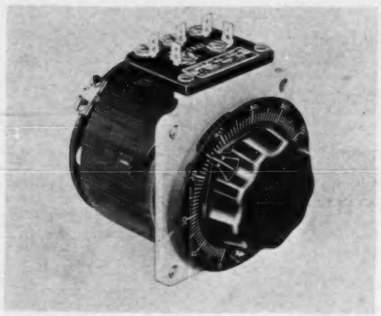
Heat Sink 330



Transistor efficiency can be increased 25 to 27 percent, preventing thermal runaway, with the 3AL-724 heat radiator. Material is aluminum per QQ-A-268 and anodize per MIL-A-8625. The eight-finned base can be tapped for either vertical or horizontal mounting on printed-circuit boards or metal chassis. The radiator is slotted through the mounting hole to allow for case diameter variations.

Birtcher Corp., Industrial Div., 745 S. Monterey Pass Rd., Monterey Park, Calif.

3.75-Amp Variable Transformers 331



A compact, 50/60-cycle, variable transformer series has been introduced, having output ratings up to 3.75 amps with constant-current loads and up to 5.5 amps with constant-impedance loads. Called the 21 Series, "Powerstats" feature several design innovations: gold-alloy plated commutator; functionally designed terminal adapters for either soldered connections or push-on connectors; adjustable 3/8-inch solid metal shaft; square-base design for increased strength, and reduced overall height and space behind panel. Single-, two- and three-gang, manually operated or motor-driven, single- and three-phase models are obtainable.

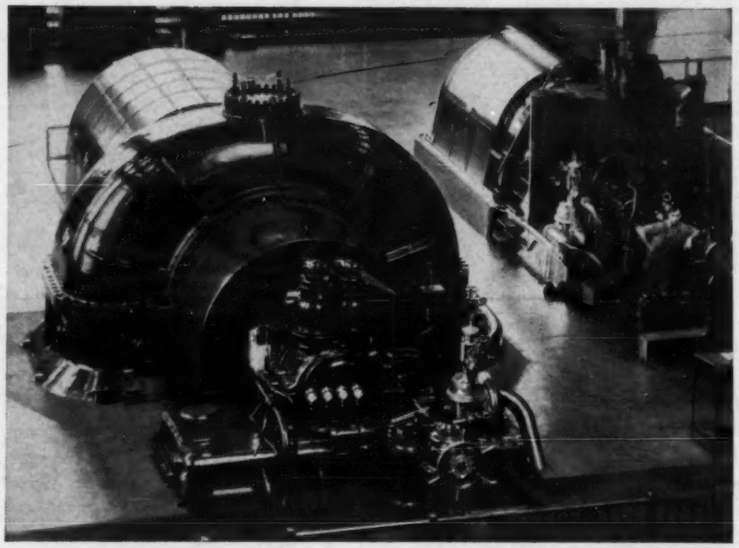
Superior Electric Co., Dept. 21, Bristol, Conn.

TURBINES:

Shell reveals three ways that Turbo Oils help prevent oil breakdown, rust, sludge and foaming

Small quantities of air and water can work their way into any turbine lubrication system. These contaminants can accelerate oxidation of the oil.

Read how Shell scientists developed a specific formulation that counters this oxidation and brings you turbine lubricating oils with top performance records.



Shell Turbo Oils lubricate turbines with total rating of more than 17 million kw in the U. S. and Canada.

WHEN oxygen attacks turbine oil, it can form peroxides and organic acids. A chain of oxidation reactions begins. If the oil stability is inadequate, sludge can form.

Air entrained in the oil can aggravate oxidation. And it may cause foaming.

The oil may also be affected by water in the system. Laboratory tests have shown that water can greatly accelerate an oxidation process.

With Shell Turbo® Oil, Shell tackles these problems in three key ways:

1. *Shell carefully selects base oils for use as turbine lubricants,* then refines them to get the most effective response to Shell's special additives.

2. *Shell adds a powerful oxidation inhibitor to its precisely refined base oils.* This inhibitor helps prevent the chain of oxidation reactions caused by oxygen exposure at operating temperatures. It helps keep the oil in good condition, and lengthens its service life.

The result is that Shell Turbo Oils have proved themselves unusually stable over long service periods.

3. *Shell uses an outstanding rust inhibitor.* As a protective measure, Shell uses special additives that cover metallic surfaces with strongly adherent polar-type films.

These films are designed to *help keep water from the metal surface.*

A message to manufacturers of turbine equipment

There are several grades of Shell Turbo Oil. One of them suits your equipment.

1. Your customers can get Shell Turbo Oils at Shell depots everywhere. Readily available throughout the world.

2. Quality is consistently high. Shell Turbo Oils always deliver top performance.

In drastically accelerated laboratory tests, metals immersed in Shell Turbo Oils show outstanding anti-rust performance—even in the presence of sea water.

Ask your Shell Industrial Products Representative for facts on Shell Turbo Oils. Or write: Shell Oil Company, 50 West 50th Street, New York 20, New York.

SHELL

A BULLETIN FROM SHELL
—where 1,997 scientists are working to provide better products for industry

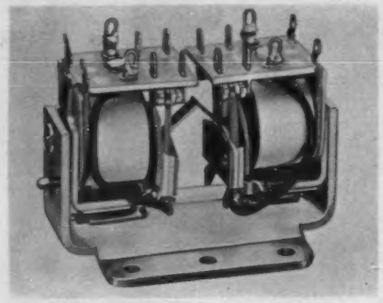
Flat Phono Plug 332



A shielded flat plug with 1/4-inch finger is useful in applications where space is at a premium and where a shielded-plug is necessary. The component has built-in cable clamp to reduce cable strain and solder lug terminals. The No. 228 lug is a two-conductor unit; where three conductors are needed, No. 238 is required. The component can be used with cables from 0.210 to 0.250 inch OD and for smaller cables by using sleeving to build up OD. Tip, rod and sleeve are of brass with bright nickel plate. Body is of steel, bright nickel plated.

Switchcraft, Inc., 5555 N. Elston Ave., Chicago 30, Ill.

A-C/D-C Latch-In Relays 333



Application flexibility, high reliability, compact size and low cost are featured in latch-in relays for direct-acting a-c and for d-c. When the armature of one relay is energized and pulled in, it is latched by interlocking levers while the other armature is released and drops out. Except for the latch-in levers, each of the two relays is complete and independent. Each may be equipped with contact combinations to 3PDT and contacts rated up to 10 amps. Units include 4PDT and 6 PDT contact combinations with 10-amp contacts for 6, 24 and 115v, a-c and d-c.

Magnecraft Electric Co., 3350P W. Grand Ave., Chicago 51, Ill.

SYLVANIA SHAVES COSTS FOR SCHICK-IN PLASTICS, METALS AND ASSEMBLIES

Producing the switch for a compact, 3-speed electric razor leaves almost no margin for error. It must be precisely built and still withstand the punishing abuse of day-to-day handling.

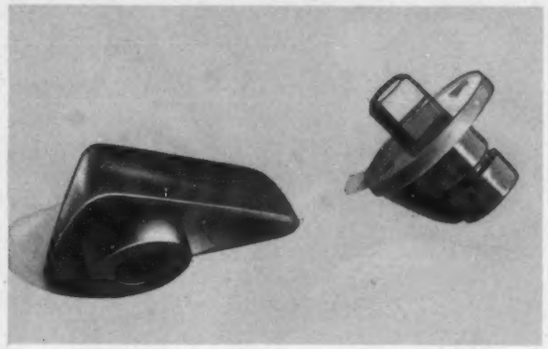
In making the switch for the new Schick razor shown below, Sylvania Parts Division meets these requirements. Our experience with a wide range of materials resulted in better electrical contacts. And our facilities assure durable, precision parts and assemblies as well as high-speed production. The combination means important economies to Schick.

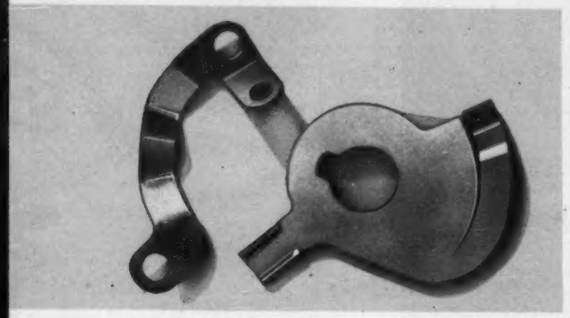
For details, see captions at the right. For full information on how Sylvania custom parts facilities can benefit *you*, or for a quote on a specific project you have in mind, write Sylvania Electric Products Inc., Parts Division, Warren, Pennsylvania.



MOLDED FROM PLASTIC are parts for the switch assembly. Each must meet the tightest specifications. Example: Sylvania molds shaft and selector button from nylon, holds dimensions on both to a height and diameter of ±.0015″. In addition, the flash is controlled to 1/32″ because the button is a snap fit on the shaft. Since Sylvania maintains one of the world's most modern and complete lines of automatic molding equipment, it can handle volume orders for compression, injection and transfer molding. And a unique bank of rotary presses can produce millions of precision parts each day—even using phenolics and urea.

Result to Schick? Precisely molded parts—in volume!



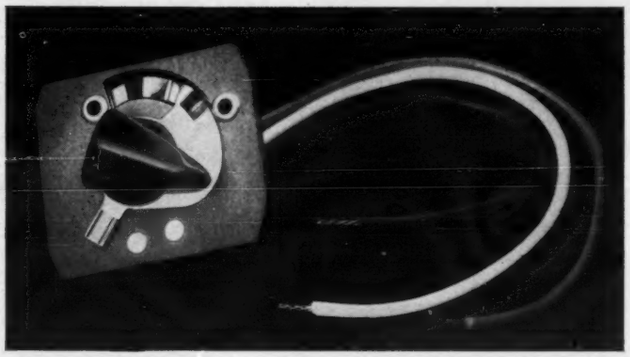


CUSTOM METAL STAMPINGS also proved important to Schick. Sylvania recommended changing the selector detent and rotor to brass, thus permitting a reduction in thickness from .015″ to .010″ and assuring an improvement in contact from rotor arm to detent. Sylvania made the dies necessary to produce these parts. The Sylvania metal stamping facility includes multi-slide machines, vertical presses and specially developed machines to help solve your problems.

Result to Schick? Positive electrical contacts assured while a 5° offset on the selector rotor is maintained to within ±1° day in and day out.

CUSTOM ASSEMBLY by Sylvania of the switch assembly is handled by our corps of trained specialists. Many of our customers have found that Sylvania can often deliver completely assembled and packaged products—using either all Sylvania components or a combination of some Sylvania and some customer supplied—*at lower cost than is possible in the customer's own facilities.*

Result to Schick? Thousands of completed, durable and precision assemblies per month.



NEED CUSTOM WELDING OR WIRE? Sylvania supplies both. To help you meet your welding needs, Sylvania has developed new high-speed, high-volume techniques and advanced welding equipment—automatic and semiautomatic. To help you with wire, only Sylvania of all major manufacturers makes all three types of bare wire—alloy, clad and plated. They're available in a full range of sizes, too—.002″ to .250″. Where necessary, Sylvania will precision-roll wire into ribbon connectors that offer high reliability when the circuitry calls for wire wrap contact methods.

SYLVANIA

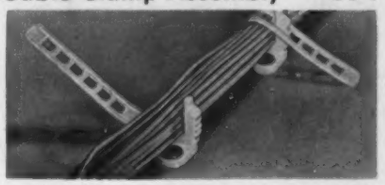
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GENERAL SYSTEM

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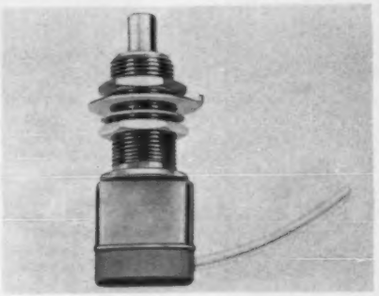
Cable Clamp Assembly 334



A clamp for both temporary and permanent assembly requires no tools for fast, easy clamping and hanging of bundles or single cables. The nylon clamp is adjustable from 3/8 to 3/4-inch dia. "Tab-Loc" clamp is reusable and is opened easily for adjustment, removal or addition of wires. Vibration tests have included 20G at 2000 cps and 50 impact shock tests from 5 to 120G. The clamp assembly provides maximum dielectric strength and corrosion resistance.

Weckesser Co., Inc., Dept. DN-1, 5701 Northwest Highway, Chicago 46, Ill.

Plunger-Type Limit Switch 335



An economical SPDT replacement switch employs corrosion-resistant material throughout, has potted leads and sealed plunger, and is qualified to MIL-S-6743. The unit also meets icing operation requirements. Operating force is 6.7 lb, ± 2.2 lb. Release force is 3.5 lb minimum. Pretravel is 3/16 inch maximum. Overtravel is 0.250 inch minimum. Weight of the switch is 0.125 lb. Rated at 5 amps resistive and 3 amps inductive at 28v d-c, 115v a-c, the switch has a minimum life of 25,000 cycles. Overall dimensions of the switch are 2 by 3/4 by 5/8 inch. Standard installation is accomplished by two hex nuts adjustable along a 15/32-inch threaded bushing. Three potted leads are 72 inches in length.

Haydon Switch, Inc., Waterbury 20, Conn.



The LGP-30 Electronic Computer begins breaking up figure-work bottlenecks the very same day it is delivered.

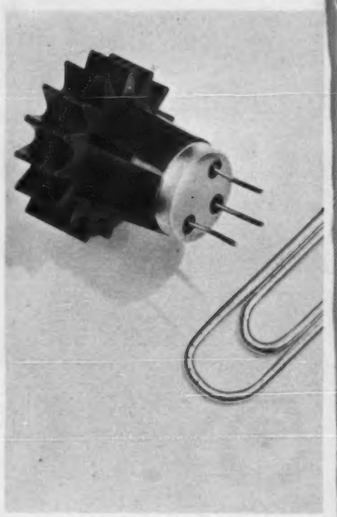
The Royal Precision LGP-30 is a complete electronic computer system that is delivered to you ready to go to work. It requires no special personnel. It is simple to program and operate . . . an engineer can use it himself. It requires no air-conditioning or expensive site preparation. In fact, it requires *no* site preparation. Just roll the LGP-30 to where it's needed and plug into the nearest convenient 110-volt AC wall outlet. It's mobile, so it goes anywhere . . . desk-size, so it takes little room.

And, though the LGP-30 can solve routine and theoretical math problems 30x faster than any man—it rents for little more than the salary of an additional engineer. Amazing? No, just well-designed, *advanced*. Let us tell you more about it. Write: Mr. Floyd Ritchie, Royal McBee Corporation, Port Chester, New York.

ROYAL McBEE / GENERAL PRECISION
ELECTRONIC DATA PROCESSING SYSTEMS

ELECTRICAL

Transistor Heat Radiator 336

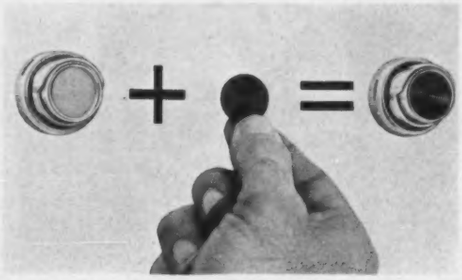


A combination transistor heat radiator and retainer, called "Kool-Tainer", is offered in two sizes, designated 3AL-725 and 3AL-728. Sides of mounting holes are slotted to accept a wide variance of case diameters from 0.310 to 0.325 and 0.475 to 0.490 inch for all the more important transistor package sizes such as TO-5, -7, -8, -9, -11, -38 and others in the same OD ranges. This feature also provides for size variations within the tolerance of any one case diameter. Available with drilled or tapped hole for attachment with rivet or screw, the retainer can be mounted back to back or nested in groups to stabilize heat in a bank of transistors. Part No. 3AL-725 has 0.65-inch OD; part No. 3AL-728 has 0.97-inch OD. Height of both is 0.5 inch. Material is aluminum alloy 2024 and finish is black anodize per MIL-A-8625. Parts are available with hard anodized finish for insulating breakdown voltage up to 200v d-c.

Birtcher Corp., Industrial Div., 745 S. Monterey Pass Rd., Monterey Park, Calif.

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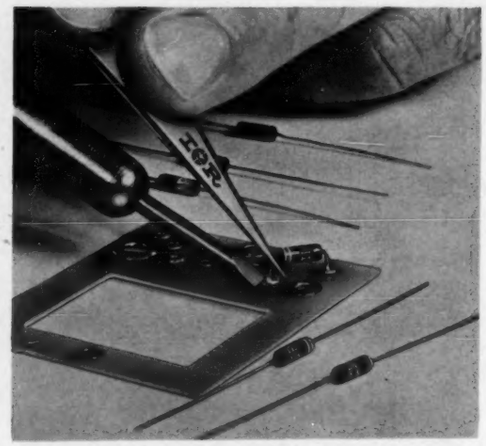
Pushbutton Color Inserts 337



A line of nonfading color inserts is now available for all of this manufacturer's oiltight pushbuttons. Inserts may be ordered in black, red, green, brown, yellow, orange and blue. Also, a "universal" package containing a basic operator and seven different color inserts is available at no extra cost.

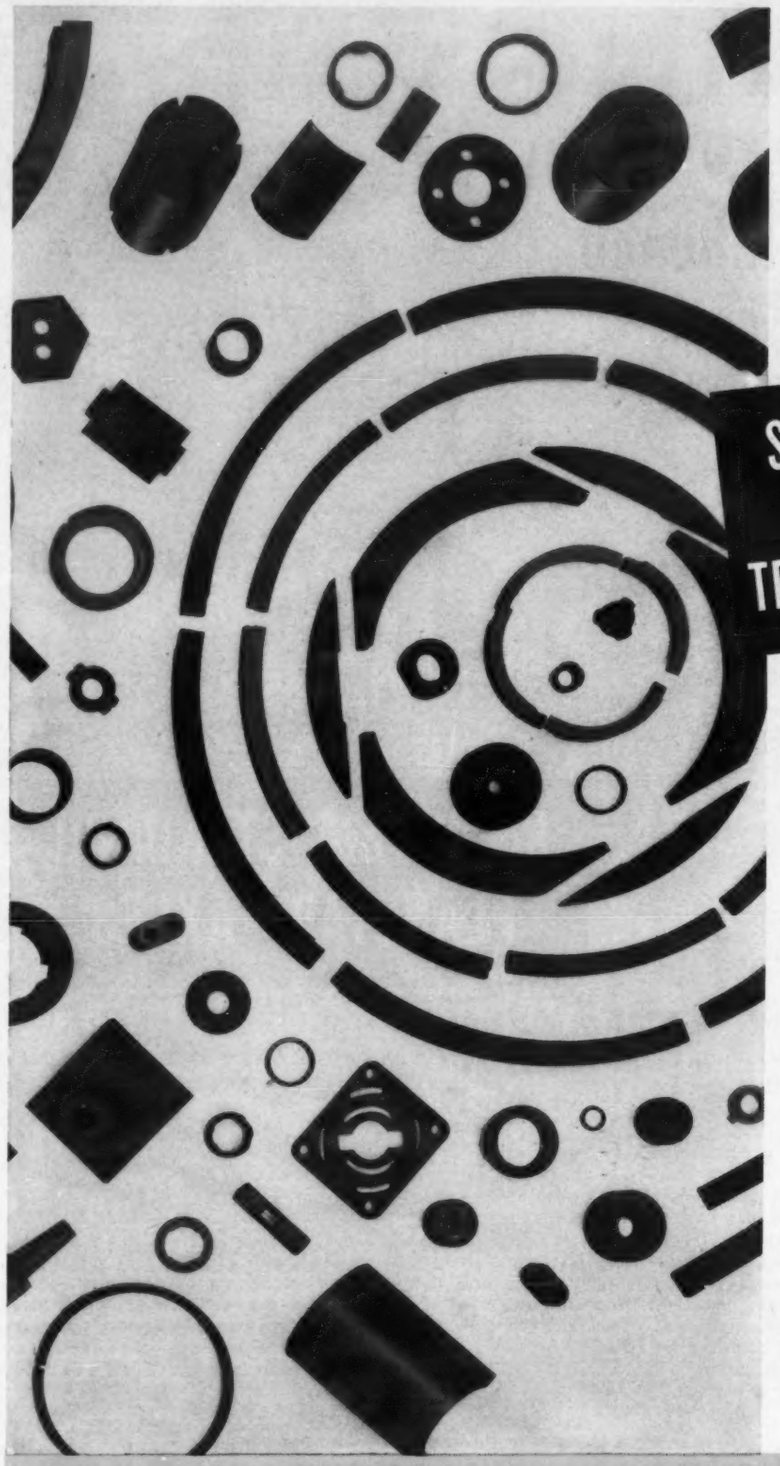
Square D Co., Dept. SA, 4041 N. Richards St., Milwaukee 12, Wis.

Glass Zener Diodes 338



In printed-circuit boards, miniature circuitry and other applications where miniaturization is paramount, subminiature glass Zener diodes offer a wide voltage range (3.3 to 30v), rated at 250 mw power dissipation. High stability and good voltage regulation over the temperature range of —55 to 150C are provided by this series. Designated Types QZ3.3T10 through QZ30T5, units are available in both 5- or 10-percent voltage tolerance types and have a maximum Zener impedance range from 5 to 70 ohms. Devices feature glass-to-metal hermetic sealing for ruggedness and optimum reliability and measure 0.265 by 0.110 inch (dia), excluding leads.

International Rectifier Corp., 1521 E. Grand Ave., El Segundo, Calif.



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STABILITY AT HIGH TEMPERATURES?

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*CARBON-GRAPHITE ESPECIALLY DESIGNED FOR MECHANICAL APPLICATIONS

Sliding or rotating components compounded and molded of **PUREBON** are unusually stable at high temperatures, self-lubricating and light in weight. Further, this material is chemically inert, moldable to size and readily machinable . . .
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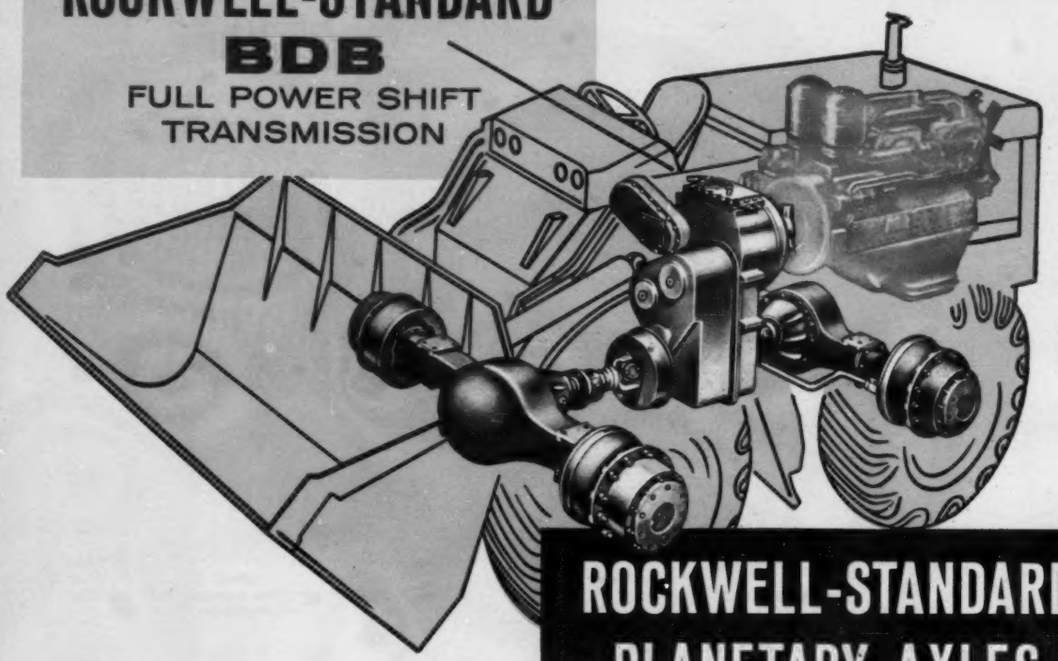


PURE CARBON CO., INC. 448 Hall Avenue St. Mary's, Penna.

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BDB
FULL POWER SHIFT
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ROCKWELL-STANDARD
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Loaders and similar heavy-duty vehicles teamed with these components are "computer matched" for a winning performance. Optimum traction, acceleration and power utilization *assure faster work cycles with larger per hour profits.*



Rockwell-Standard type BDB Hydra-Drives transmission combines in one package the desirable features of a hydraulic torque converter and full power shift transmission with compact "built-in" drop box construction. Clean, rugged, four-speed countershaft design reduces maintenance costs. Built to last, it contains up to 35% fewer parts, is easier to understand and quicker to service.



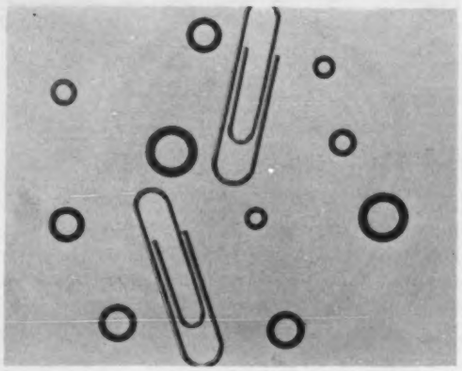
Rockwell-Standard Planetary Axles assure dependable, rugged, efficiently designed units capable of maximum performance on any heavy duty operation. Exclusive features provide equal distribution of loading to all planetary gears—a minimum of maintenance—constant lubrication of all parts—and a full range of capacities in rigid and steering axles.

Another Product of... **ROCKWELL-STANDARD CORPORATION**
Transmission and Axle Division, Detroit 32, Michigan

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MATERIALS

Silicone O-Rings 339



Special O-rings, tradenamed "Silic-O-Rings", are said to be virtually "flashless" (flash is held to a maximum of 0.001 inch on all units). They are offered in a range of very small sizes not normally available from conventional sources. Silicone's high and low temperature characteristics offer resistance to chemicals, ozone and aging.

A.P.M. Corp., 41 Honeck St., Englewood, N.J.

Instrument Housings 340



Hermetically sealed instrument housings feature a glass-to-metal bond resistant to thermal and mechanical shock per MIL-G-8798 and hermetic seal per MIL-G-8798. Units are available in aluminum, brass and stainless steel, with a super-thin wall to save weight. Deliveries on housings conforming to MS 33639 of any length can be accomplished with a minimum of lead time. Glass can be supplied either plain, heat treated, uncoated or coated to JAN F-687 specifications.

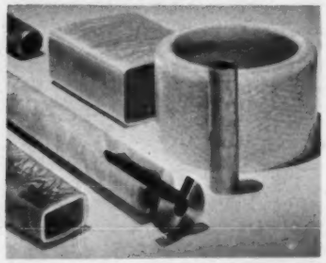
Micro Precision Corp., 55 Ninth St., Brooklyn 15, N.Y.

Epoxy Rubber 341

A low-viscosity liquid material with either a room-temperature or oven-curing system, polymerizes to Shore A hardness, exhibits good adhesion to all materials and exceeds MIL-S-8516. This rubber-like material is used for enclosing wire-cable splicings, which need an insulating, moisture- and shock-proofing package. The resin can be modified to be used for vibration-damping moldings of cast parts or as an excellent flexible adhesive in thin films.

Rad Electronic Plastics, Inc., 1466 Herkimer St., Brooklyn 33, N.Y.

Glass-Epoxy Tubing 342



"GFW-60", a glass-filament wound-epoxy tubing, provides industry with a tubing material whose burst strength properties exceed those of the familiar G-10 grades by about 3 to 1. The material makes it possible to achieve exact ratios between burst and tensile strengths to meet the requirements of specific applications. The tubing has applications in high-voltage fuse tubes, switchgear and other components requiring high burst strength. It is available in a variety of circular sizes and lengths or in special cross-section shapes such as rectangular. It can be furnished in combinations with vulcanized-fiber tubes or metal inserts.

Spaulding Fiber Co., Inc., 310 Wheeler St., Tonawanda, N. Y.

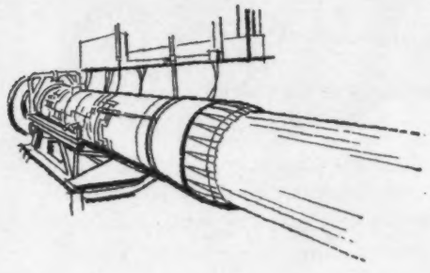
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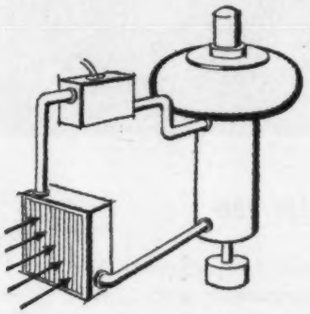
SILICONES

GOING INTO HUNDREDS OF PRODUCTS WHICH NEED THE THERMAL STABILITY, LONG LIFE, CONSTANT VISCOSITY AND COMPRESSIBILITY OF

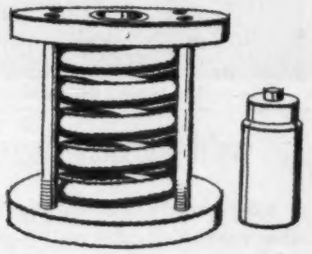
General Electric Silicone Fluids



Extreme temperature lubricants For high temperature lube applications, General Electric silicone lubricating fluid Versilube F-50 gives unmatched thermal and oxidative stability over the temperature range of —100°F to 600°F. Its lubricity is unequalled at temperatures as high as 600°F, and comparable to other fluids in the moderate ranges. Excellent hydrolytic stability. Not corrosive to common metals.



Dielectric coolants The extreme long life and thermal stability of G-E silicone fluids make them ideal as heat transfer media. Fluids of the SF-97 series can be pumped over a wide temperature range and will last indefinitely at 300°F in the presence of air, and more than 500 hours at 570°F in the absence of air. Further benefits include low volatility, chemical inertness, resistance to oxidation, and high dielectric strength.



Compressible fluids This liquid spring, which utilizes the compressibility of G-E silicone fluids, can do the same work as a conventional spring five times as heavy. All G-E silicone fluids have relatively constant viscosity over wide temperature ranges, and high-temperature stability. Viscosities range from 5 to 100,000 centistokes at 25°C. Ideal for hydraulic fluids, fluid drives, dashpots, and dampers.

The benefits of General Electric silicone fluids find uses in hundreds of products, from jet engines to suntan lotions. To learn more about these versatile, problem-solving fluids, write: General Electric Company, Silicone Products Dept., Section D647, Waterford, New York.

GENERAL ELECTRIC



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. . . we'll put them together for you

When you are choosing materials for new designs, or when conducting value analysis on existing products, don't compromise on the qualities the parts must have. If you are now using single metals or alloys, chances are you're compromising.

For example, if you need thermal and electrical conductivity, and springiness, no one metal can give you the optimum in all three requirements.

That's where MULtiLAYER clad metals fit into the picture. We will give you a spring steel base material with a layer of copper clad to it and will weld and coin a gold contact ball onto the blade for electrical conductivity. Besides giving you more beneficial engineering properties, MULtiLAYER will probably save you money because you will need less precious metal.

MULtiLAYER, with its hundreds of possible combinations, gives you another modern material. Take advantage of it. WRITE for our general catalog, GP-1B, which describes this material in more detail and illustrates many thought-provoking applications.



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INCORPORATED



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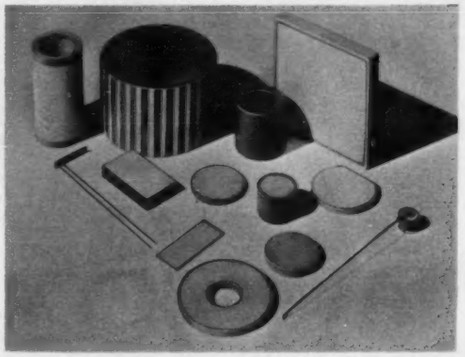
Fiber-Glass Cloth Tape 343



Electrical tape for maintenance, splicing, sealing and insulating components exposed to high heat is available in 1/2-inch by 66-ft job-sized rolls. Tape is used to insulate and splice appliance wiring, for Class B insulation in motors and generators, for sealing hot-air ducts and fire walls. "Permacel 21D" has a glass-cloth backing with a rubber-based, pressure-sensitive, thermosetting adhesive. It is free of corrosive elements and does not contain sulphur. When subjected to heat, the adhesive becomes more firm and binds even more securely to the surface to which it is applied. Seven mils thick, the tape has a tensile strength of over 100 lb-in width.

Permacel, New Brunswick, N.J.

Piezoid Ceramic 344



This material has electric properties which make it useful for a wide range of transducer applications. Composition "KE-14" can be used in underwater sounding apparatus, ordnance systems, sensing gages, ultrasonic equipment and many other devices. The material is manufactured in an almost unlimited variety of shapes. Discs, cylinders, tubes, plates and blocks can be supplied, as well as unsymmetrical shapes. It has a stable dielectric constant from 55 to 300C.

Centralab, Electronics Div. of Globe-Union, Inc., 900A E. Keefe Ave., Milwaukee 1, Wis.



MULtiLAYER provided *all* these metal qualities for heat exchanger fins used in supersonic aircraft and missiles. Designed with a copper core for greater thermal conductivity, the fins thus increased the efficiency of the exchanger. Soft tempered stainless steel cladding was selected for its anti-corrosion properties, and for its conformability when wound around the exchanger in a spiral. It was also wetable by Coast Metal #53 brazing alloy to insure a continuous, high-strength connection. If the metal qualities required of your product are equally or more diverse, MULtiLAYER can solve *your* problem as well. Write for FREE LITERATURE describing physical and mechanical characteristics of this strip, and other specifications such as coefficients of expansion, forms and sizes, and weights.

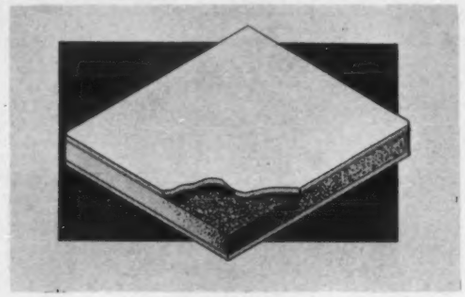
METALS & CONTROLS INC.,
1206 Forest Street, Attleboro, Mass.

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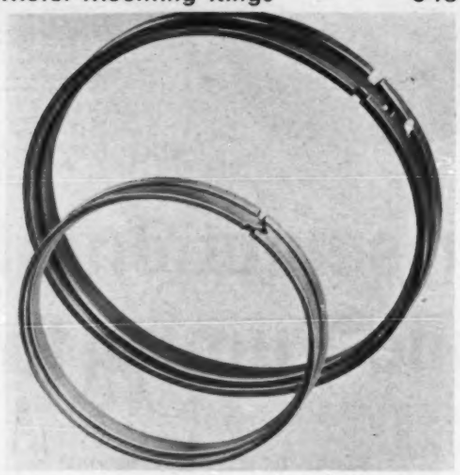
Sprayable, Nonflammable Adhesive 345



"Rulabond No. 988", a sprayable, noncombustion-supporting adhesive is recommended for use in bonding a variety of materials (treated wood, metals, plastics, ceramics, porcelains and synthetics) where noncombustibility of the composite is a requirement. This adhesive is applied easily to any clean surface and dries rapidly for quick layup, meeting ASTM specifications for nonflammability.

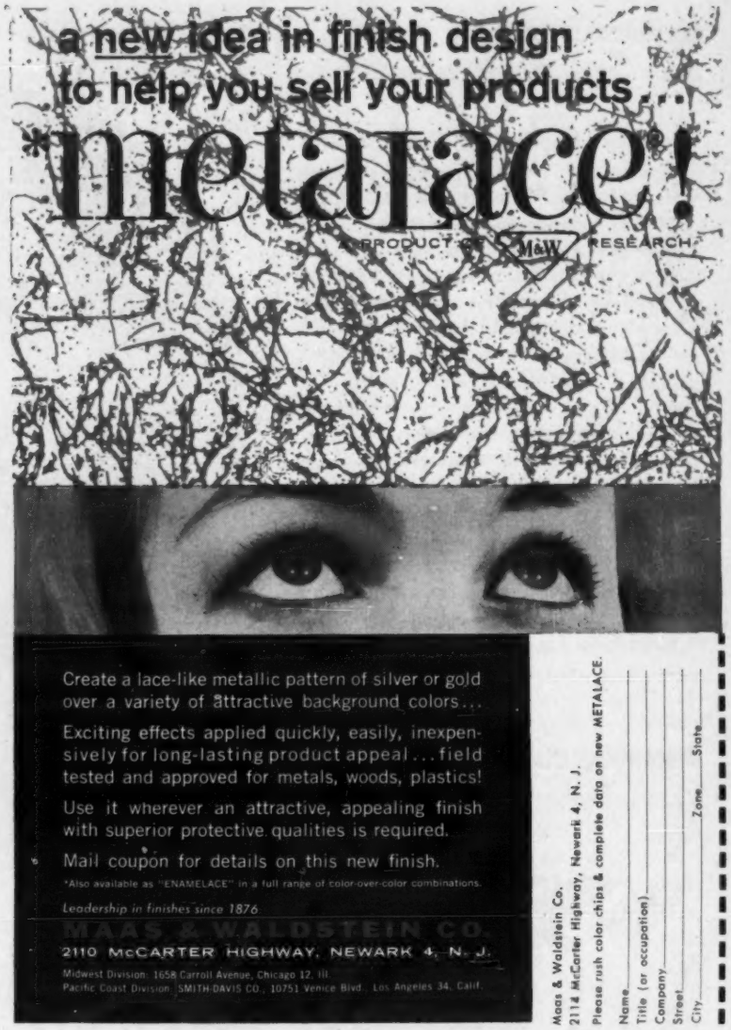
Rubber Latex Co. of America, 110 Delawanna Ave., Clifton, N.J.

Motor Mounting Rings 346



A line of popular-sized electric motor mounting rings features a new method of incorporating the center rib—resulting in sharper corners desirable to motor manufacturers. The rings are manufactured with either "T" or "V" interlocking closures which prevent their intertwining during shipment, storage and handling. They are produced on high-production multislide press equipment which not only provides top-quality products but also at a lower cost. Mounting rings are available in plain finish or can be plated at slight additional cost.

Detroit Stamping Co., 330 Midland Ave., Detroit 3, Mich.



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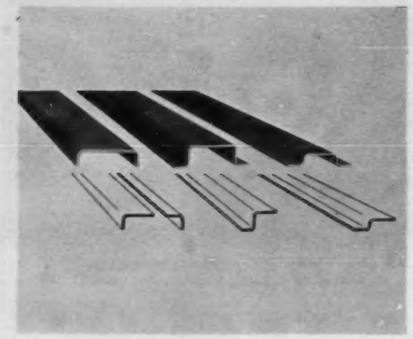
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One-Part Epoxy Dip Coat 347

"Eccocoat D30" is an epoxy-resin dip-coating compound which provides a strongly adhesive surface coat with good moisture resistance on transformers, capacitors and similar components. It is easy to apply by conventional dip-coating procedures. When preheated parts are dipped, the resin gels on the surface of the part and will not run or drip during the oven-cure cycle. The amount of pickup can be controlled by preheat temperature and immersion time. During cure, there is no evolution of volatile materials and cured surface coat is impervious and provides protection against moisture and weather. A controlled amount of flexibility in the cured resin imparts outstanding resistance to thermal and mechanical shock.

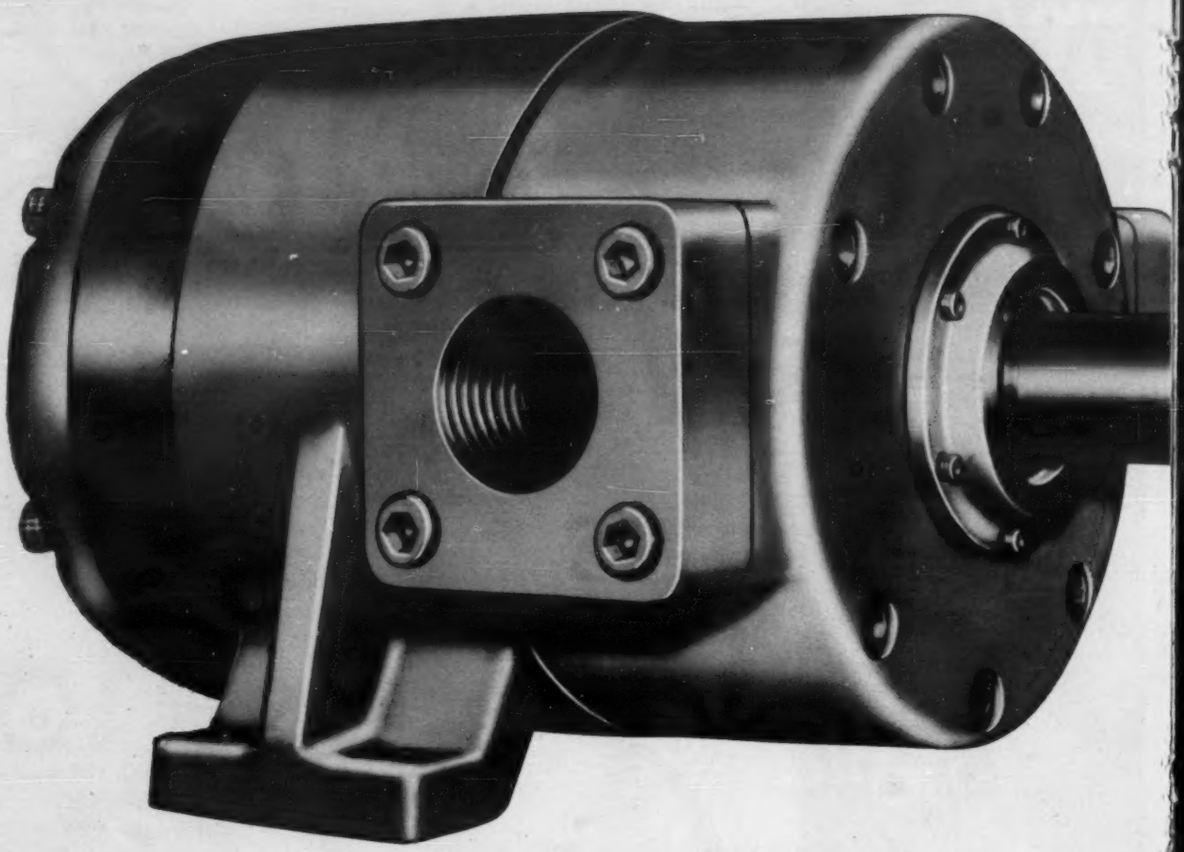
Emerson & Cuming, Inc., Canton, Mass.

Insulating Channel 348



This high-strength, fiber-glass-reinforced polyester shape can be used as is or cut into angles or other forms to meet specific job requirements. Applications include component bases, insulating offsets, bus supports, enclosures, cable supports, transformer corners, fuse mountings, wire raceways and stiffening bars. The material is engineered for use in equipment operating at Class B temperatures (130C). It meets NEMA GPO-1 specifications and has UL-recognized flame retardance. Widths range from 2-3/16 to 9-21/32 inches, lengths range to 76 inches and thicknesses range from 1/16 to 3/8 inch.

Glastic Corp., 4321 Glenridge Rd., Cleveland 21, Ohio.



Proper selection of constant Hydraulic Pumps for systems

By: Ellis H. Born
Director of Sales-Engineering
Denison Engineering Division
American Brake Shoe Co.
Columbus, Ohio

Whether to use a high pressure system or a low pressure system is perhaps the most basic decision the designer faces in developing the proper hydraulic system. This decision involves such factors as efficiency, space requirements and, most important, cost.

SPACE CONSIDERATIONS

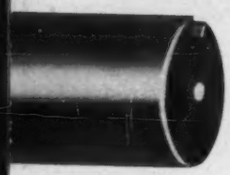
Furnishing fluid horsepower is the function of a hydraulic system. Horsepower yield is determined by multiplying system pressure (psi) times flow rate (gpm) times a constant of 0.000583. Application of this formula reveals that a 5000 psi system develops five times the horsepower of a 1000 psi system at the same rate of flow. Accordingly, the 5000 psi system requires only 20% of the flow rate of a 1000 psi system to produce the same fluid horsepower.

Reduced rate of flow permits designs which incorporate smaller valves, piping, hydraulic cylinders and reservoirs. Since reservoirs are often the largest single fluid component in a system, appreciable space savings can be realized with high pressure systems. If recommended hydraulic practice is followed, reservoir capacity is three times greater than the gpm displacement of the pump. Hence, for the same amount of fluid horsepower, reservoir capacity can be reduced as much as 80% in a high pressure system. The high

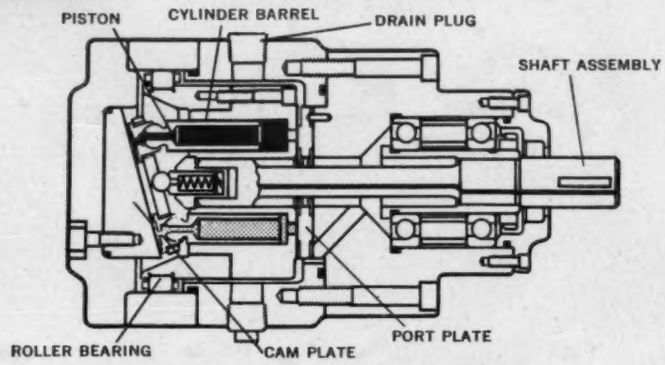
MOUNTINGS



FLANGE FACE and PEDESTAL BRACKET



Denison constant volume axial piston pumps offer volumes up to 122 gpm, pressures to 5000 psi, at their rated speeds of 1200 and 1800 rpm. Face, flange, bracket or pedestal mountings are available for ready adaptation to your particular installation. Models are available for either clockwise or counter-clockwise rotation.



DETAILS OF CONSTRUCTION

volume Axial Piston up to 5000 psi

pressure system not only allows savings in space through use of smaller components and capacities, but reduces the weight and mass of the hydraulic power package as well.

COST FACTORS

Use of smaller components in high pressure systems not only saves space, but affords worthwhile cost reductions.

Compact system elements cost less and because they are smaller, as well as lighter, assembly is easier and faster. Raw material requirements are also reduced. These advantages permit the over-all hydraulic system design to incorporate less weight and mass. The latter is especially important where portability is concerned.

SYSTEM EFFICIENCY

In any hydraulic system, a part of the generated fluid horsepower is used to force fluids through the system. Resultant line and pressure decreases are far less significant in high pressure systems. For example, a pressure drop of 50 psi represents a loss of 5% in a 1000 psi system, but only a 1% loss in a 5000 psi system. It follows that high pressure systems have an inherent efficiency advantage over low pressure systems.

The ability to provide sustained efficient power for a high pressure system is best fulfilled by a precision-built axial piston pump because of its low slippage rate and operating characteristics.

All internal forces created by hydraulic pressure against the moving parts are counteracted by the use of hydraulic balancing.

Using the principle of hydrostatic balancing eliminates the need for expensive and often cumbersome thrust bearings in the pump. This design minimizes pump size and allows a more compact pump or fluid motor package.

Other advantages are gained through hydrostatically balancing pistons and the cylinder barrel. For example, excessive loading of piston shoes against the cam plate is avoided. In addition, excessive loading of the cylinder barrel against the port plate is prevented, virtually eliminating wear caused by sliding action.

Life expectancy of internal axial piston pump parts is almost infinite since constant lubrication is supplied by system fluid.

Data and specifications on 5000 psi pumps, motors and controls are available from your Denison representative—located in principal cities—to assist you in developing hydraulic systems for maximum efficiency and economy.

NEW CATALOG FOR DESIGNERS AND ENGINEERS



Write for your copy of Bulletin 220—"Hydraulic Power to 5000 psi". Includes complete specifications, operating data and applications for Denison's full line of hydraulic pumps, motors and controls.

DENISON ENGINEERING DIVISION
American Brake Shoe Company
1190 Dublin Road • Columbus 16, Ohio

Circle 70 on Reader-Service Card for more information

Contact Adhesive 349

A contact adhesive bonds decorative and other laminates to wood, paper and metals. "Clairstick" gives instantaneous tack with long open time, has a coverage of 300 sq ft per gal and provides a fast, strong, elastic and permanent bond. The adhesive can be applied by spray, brush, trowel or paint roller and is claimed to do a good bonding job with hand pressure or pinch rollers. Working samples are available.

St. Clair Rubber Co., 107 Clifford, Detroit, Mich.

Iron-Chromium-Aluminum Wire 350

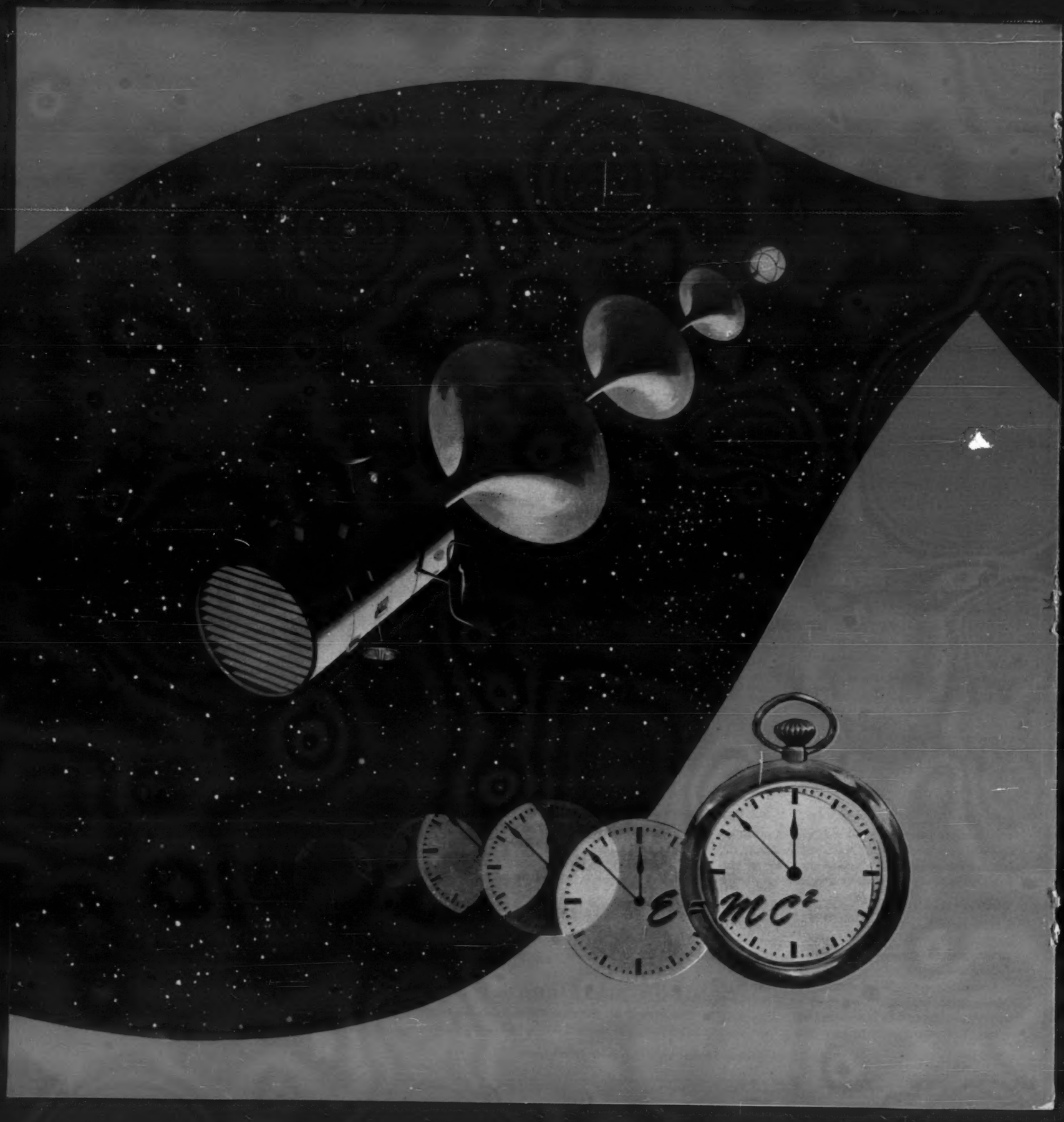
An improved iron-chromium-aluminum alloy is essentially a magnetic alloy with good mechanical properties and some corrosion resistance suitable for manufacturing of resistors where cost is a critical factor. "Mesoloy" is available in varied diameters ranging from 0.010 to 0.0005 inch, in either bare or enameled wire. Specific resistance is 825 ohms per cmf at 20C (68F). Other physical characteristics vary proportionately with the diameter of the wire. The wire can be soldered with a suitable, non-corrosive flux or welded by standard resistance techniques.

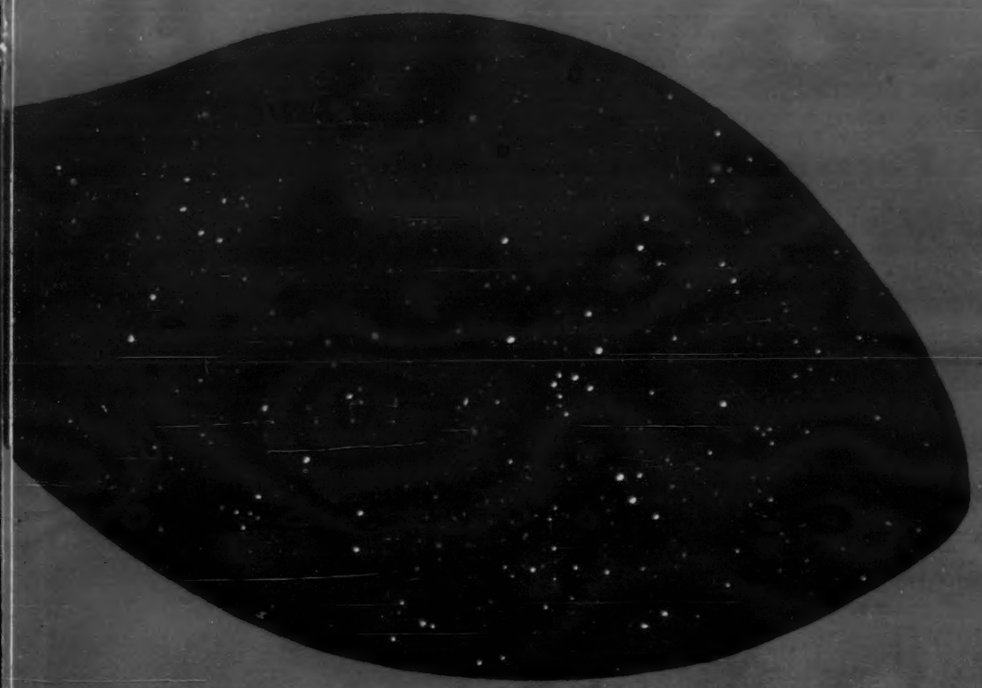
Molecu-Wire Corp., Eatontown-Freehold Pike, Scobeyville, N.J.

Rod-Form Epoxy 351

Epoxy in "Rod Form", 72 inches long, meets all military specification performances. Four standard types of formulations are offered: No. 31 (260F, HDT); No. 32 (310F, HDT); No. 33 (345F, HDT); No. 34 (410F, HDT); all diameter tolerance over the entire 72-inch length are within ±0.001 inch. This longer length of epoxy rod enables the fabricator to gain a competitive edge with a 50-percent reduction of his scrap and a 100-percent increase in productivity by using a 72-inch, highly machinable rod versus the shore lengths.

Rad Electronic Plastics, Inc., 1466 Herkimer St., Brooklyn 33, N.Y.


E=MC²



FACING THE FOURTH DIMENSION IN PROPULSION DEVELOPMENT

Whether the universe has a "saddle shape," or any shape at all, is a matter of interesting conjecture. The matter of space travel, however, is the subject of intense experimentation. A nuclear/thermionic/ionic propulsion system, currently being studied at Lockheed Missiles and Space Division, might well become the power source for space vehicles.

Its design incorporates a nuclear reactor only one foot in diameter, generating heat at a temperature of 1850°K. This is transmitted to banks of thermionic generators, converting the heat directly into electrical energy for the ion beam motor which uses cesium vapor as a fuel. The entire system is designed without any moving parts, minimizing the possibility of failure.

Lockheed's investigation of propulsion covers a number of potential systems. They include: plasma, ionic, nuclear, unique concepts in chemical systems involving high-energy solid and liquid propellents, combined solid-liquid chemical systems. The fundamentals of magnetohydrodynamics, as they might eventually apply to propulsion systems, are also being examined. Just as thoroughly, Lockheed probes all missile and space disciplines in depth. The extensive facilities of the research and development laboratories—together with the opportunity of working with men who are acknowledged leaders in their fields—make association with Lockheed truly rewarding and satisfying.

Lockheed Missiles and Space Division in Sunnyvale and Palo Alto, on the beautiful San Francisco Peninsula, is an exciting and challenging place to work. For further information, write Research and Development Staff, Department M-24B, 962 West El Camino Real, Sunnyvale, California. U.S. citizenship or existing Department of Defense industrial security clearance required. All qualified applicants will receive consideration for employment without regard to race, creed, color or national origin.

Lockheed / **MISSILES AND SPACE DIVISION**

Systems Manager for the Navy POLARIS FBM and the Air Force AGENA Satellite in the DISCOVERER and MIDAS Programs

SUNNYVALE, PALO ALTO, VAN NUYS, SANTA CRUZ, SANTA MARIA, CALIFORNIA • CAPE CANAVERAL, FLORIDA • HAWAII

Color-Coded Connector Cables 352

Cables for tape, magnetic phono, ceramic phono, tuner, amplifier, microphone and speaker are coded in five new colors for quick, easy identification. Cords are supplied in basic colors (white, green yellow, red and blue). Cables are of colored, flexible, plastic-covered, shielded cable; handles are injection-molded plastic with added length for easy grasping.

Zoron, Inc., 612 W. Monroe St., Chicago 6, Ill.

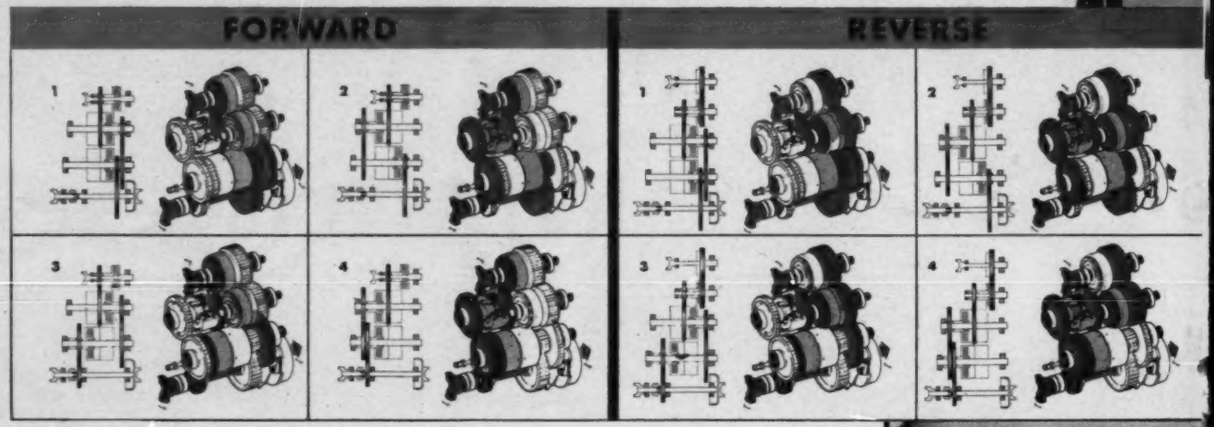
Pneumatic Rod Packing 353

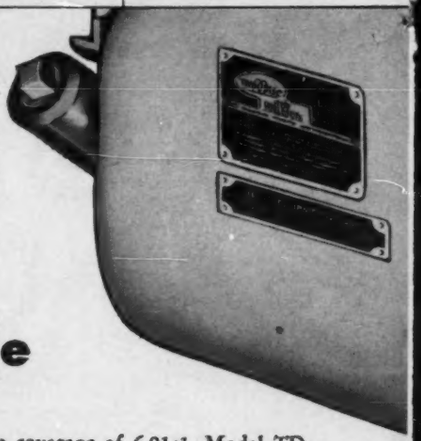


A new type of hydraulic or pneumatic rod packing consists of a D-ring for positive sealing action and double, wedge-shaped, backup rings which provide added security, a secondary seal and protection from extrusion. Pressure produces a double cam action in the wedges, which extends them fully against the rod and gland OD and closes the rod clearance so extrusion is prevented at both the rod and the D-ring heel. Rear wedge terminates in a wiper lip and entire assembly installs into a simple counterbore in the cylinder head, held by a snap ring.

Greene, Tweed & Co., North Wales, Pa.

4 Speeds Forward...4 Speeds Reverse
FULL POWER SHIFT IN ALL RATIOS





New TWIN DISC TRANSMISSION

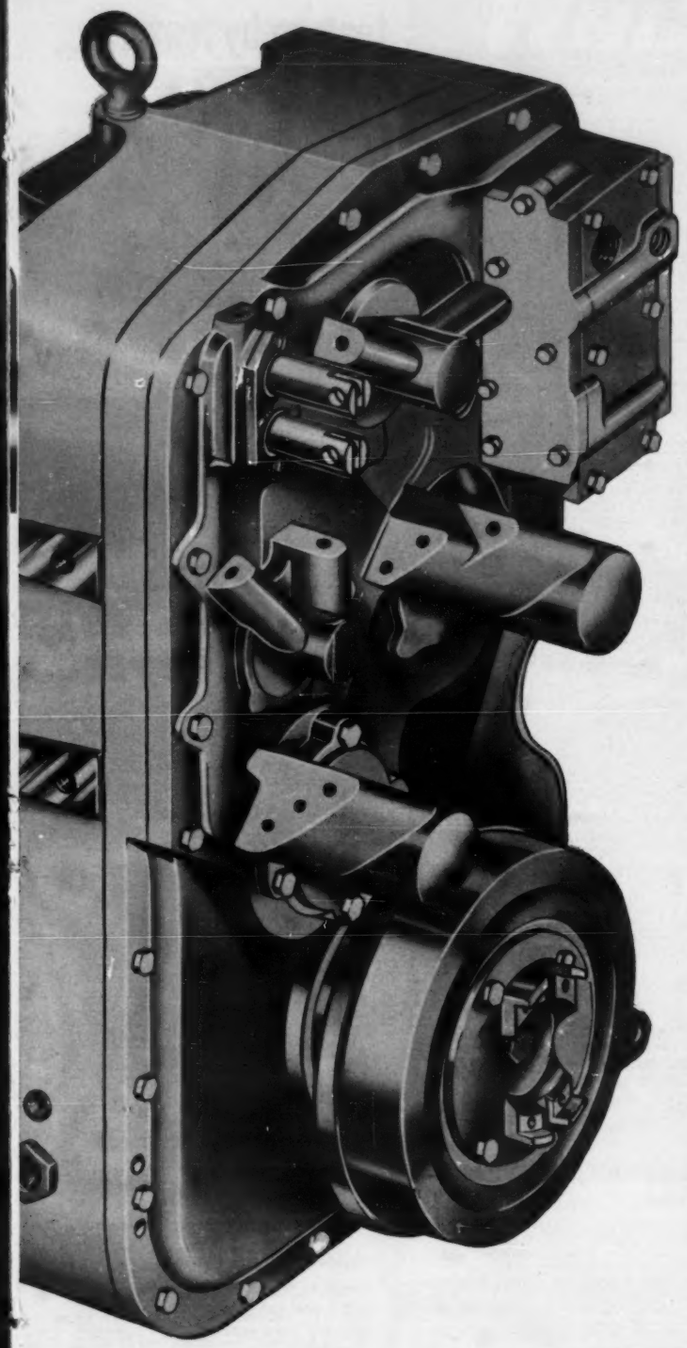
for engines in the 100 hp range

The Twin Disc "engine to axle" concept in OEM power transmission components takes another giant step forward with the introduction of the Series TD-44-400 Power-Shift Transmission. This new Twin Disc design is a four speed forward, four speed reverse box with full power-shifting in all speeds. Designed for engines developing from 75 net hp at 1800 rpm up to 108 net hp at 3000 rpm,* Series TD-44-400 includes two models with an over-all ratio coverage of 6.91:1. Model TD-44-403 has ratios of 4.89, 3.19, 1.08 and .705; Model TD-44-404 has ratios of 5.98, 3.92, 1.32 and .866.

*This is rated horsepower delivery after power is taken off for auxiliary drives.

Simple design, positive operation

The complexities of planetary designs are avoided in the transmission's simple countershaft arrangement. Multiple-disc oil-actuated clutches energize the constant-mesh spur gear trains. The speed changes are effected by two



duplex clutches that function as range clutches.

Two large single clutches handle the direction-changing job. Oil-cooled for maximum heat dissipation, they act as the energizing clutches for all engagements.

Shockless clutching

Clutches are engaged by means of a cascade system of oil pressure regulation. A controlled pressure rise valve increases the pressure steadily and rapidly. This patented feature makes for exceptionally smooth clutch engagement.

The brake-regulated clutch release valve is ported for direct connection to the vehicle's brake fluid system. Thus, by depressing the brake pedal, the operator releases all clutches in the transmission, instantly cutting off the power source for vehicle movement.

Both ends of the output shaft feature yoke-type U-joint connecting members as standard equipment. Also standard is a parking brake and a disconnect jaw clutch on the output shaft. This jaw clutch may be engaged for four wheel drive or disengaged for single axle drive.

Easy servicing

In designing the Series TD-44-400 Transmission, Twin Disc engineers have made easy servicing a prime requisite. Removal of the main housing cover gives complete access to all clutches and range gears. Anti-friction bearings are used throughout. The simple power train and relatively few parts can be readily appreciated when contrasted with the complex power flow and multiplicity of parts in a planetary gear transmission.

Torque converter-transmission package

The TD-44-400 Transmission is normally furnished with a Twin Disc Single-Stage Torque Converter as a package unit. The converter is a sumpless model featuring two power take-off points. One is normally used for power steering. The other incorporates an SAE "C" pump mounting suitable for hydraulic power pumps.

Series TD-44-400 is one of a complete line of converter-transmission packages being developed at Twin Disc's Transmission Division. Twin Disc engineers will be pleased to make recommendations for these units in your vehicle drive. Contact the Transmission Application Engineering Department at our Racine office.

TWIN DISC CLUTCH COMPANY, Racine, Wisconsin; *Hydraulic Division,* Rockford, Illinois.



Circle 71 on Reader-Service Card for more information

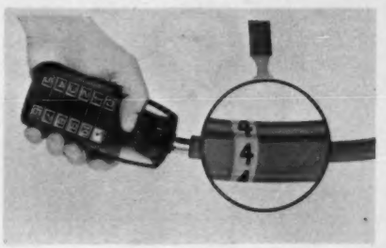
Slip Ring Assemblies 354



"Teflon"-clad slip rings are capable of handling high voltages without characteristic arcing damage, even under operating conditions of extreme humidity. At the same time, they maintain very high resistance between circuits and offer inertness throughout temperature range of −200 to 200C. The electrically pretested "Teflon" sheets are used in a three-step forming operation. Final slip-ring assembly consists of a molded "Teflon" shell filled with epoxy.

Electro-Tec Corp., 10 Romanelli Ave., South Hackensack, N.J.

Wire-Marking System 355



A new way of marking circuits after identification enables an electrician to label both ends of up to 50 circuits quickly and easily. Designed to be used in conjunction with the "Amprobe Cable Tracer" (an instrument which allows one man to trace and identify circuits), the wire markers are divided into strips numbered from 1 to 10, printed on a colored, adhesive-backed cloth tape. Tape is affixed to a cardboard stiffener. Each numbered strip is subdivided in half to permit marking both ends of a conductor. "Trace-Tabs" are available in packages of 10 cards: two each of five contrasting colors (green, orange, blue, yellow and white).

Pyramid Instrument Corp., 630 Merrick Rd., Lynbrook, L.I., N.Y.



FERRO-TIC combines the fabricating advantages of steel with the wear-resistance of carbide. In the annealed, completely dense state, **FERRO-TIC** can be machined with high-speed tools on conventional tool room equipment; thus, the need for costly diamond grinding is eliminated. Once hardened, by oil quenching from 1750°F, **FERRO-TIC** is extremely hard and wear-resistant. **FERRO-TIC** stock blanks can be fabricated into long-wearing components, using available tools and skill without delay! **FERRO-TIC** is ideal for: Blanking, Lamination, Deep Drawing and Heading Dies, Arbors, Core Rods, Wear Parts, etc. **FERRO-TIC** can be turned, drilled, milled, sawed, tapped . . .

Sintercast

AGENTS THROUGHOUT THE U. S. A.
WRITE FOR ILLUSTRATED BULLETIN D-6

Division of **CHROMALLOY CORPORATION**
169 Western Highway, West Nyack, N. Y. • ELmwood 8-5900

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CHROMIZING CORPORATION, LOS ANGELES, CALIF.
PROPELLEX CHEMICAL DIVISION, EDWARDSVILLE, ILL.
ELYRIA FOUNDRY DIVISION, ELYRIA, OHIO

*Reg. U.S. Trade Mark

Circle 72 on Reader-Service Card for more information

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Usable Design Ideas

EQUIPMENT

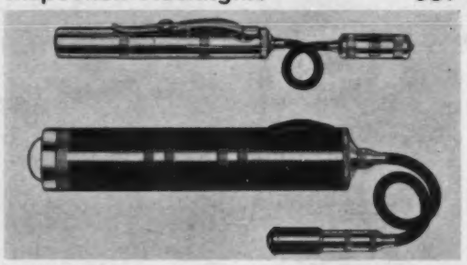
Circular Slide Rules 356



Combining characteristics of both straight rules and conventional circular slide rules, "Acudials" provide a rapid means of calculation with one hand. Principle of moving scales of this rule is the same as that of a straight slide rule, but revolving-disc construction eliminates resetting required by straight rule. Six models are available, each suited to a different type of work. All markings are deeply engraved. Rule is boxed with a pocket case and complete instructions.

Fullerton Engineering Sales Co., 4623 York Blvd., Los Angeles 41, Calif.

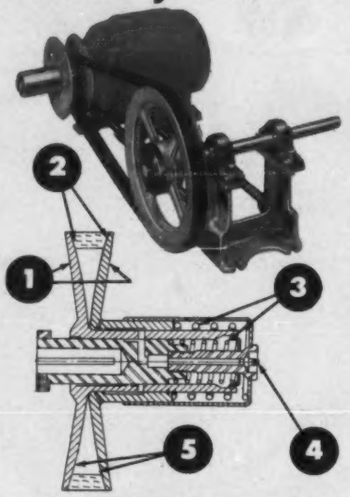
Inspection Flashlights 357



Three models of portable flashlights furnish illumination where normal "visual inspection" is difficult. "Flex-Lites" have anodized-aluminum cases and completely flexible vinyl-covered extensions, and use standard-sized batteries. Series 300 features a pocket-clip lock and rotating head switch, leaving both hands free. Series 200 and 500-A have a focusing head to adjust beam from pinpoint to wide spot. These models also have a spare bulb inside base and a bail hanger. Optional 6-inch rigid extension bar can be furnished. Applications of the flashlights include dies, castings, tool rooms and machine-shop inspection.

Aero-Motive Mfg. Co., 1803 Alcott St., Kalamazoo Mich.

feature by feature...



INDUSTRY'S MOST EFFICIENT VARIABLE SPEED PULLEY

1. Both sides of the driving disk open simultaneously and equally to give constant belt alignment.
2. Power is transmitted through sides of the belt to a grooved sheave to insure maximum efficiency and prevent slippage.
3. Each side of the driving disk is independently actuated by its own spring, eliminating rachets, cogs, gears or other moving parts subject to constant maintenance and wear.
4. Oilite bronze bushings on fractional hp. units provide life-time lubrication.
5. Curved pulley faces maintain full contact with belt sides at all times, greatly increasing overall efficiency.

Pulleys are available in a complete range of sizes, fractional to 15 hp.—full 3 to 1 ratio. Immediate delivery from stock.

Request recommendations for your application. Ask for Catalog P-58.



Lovejoy FIRST NAME IN VARIABLE SPEED PULLEYS

LOVEJOY FLEXIBLE COUPLING CO.
4812 West Lake Street, Chicago 44, Illinois
Telephone: EStebrook 9-3010

Circle 73 on Reader-Service Card

Epoxy Motor-Repair Kit 358

Use of these two systems for impregnation and sealing of motor windings increases service life and improves resistance of the motor to corrosive and deteriorating conditions. "Permacel PRH-500" is a two-part epoxy system—an impregnating resin and a hardener. This kit is recommended for impregnating motor-coil windings. Improved moisture resistance and heat dissipation are the direct result. The second two-part kit, designated "Permacel PRH-510", is used for sealing and capping motor coil windings.

Permacel, New Brunswick, N.J.

Shaving and Cutting Plier 359

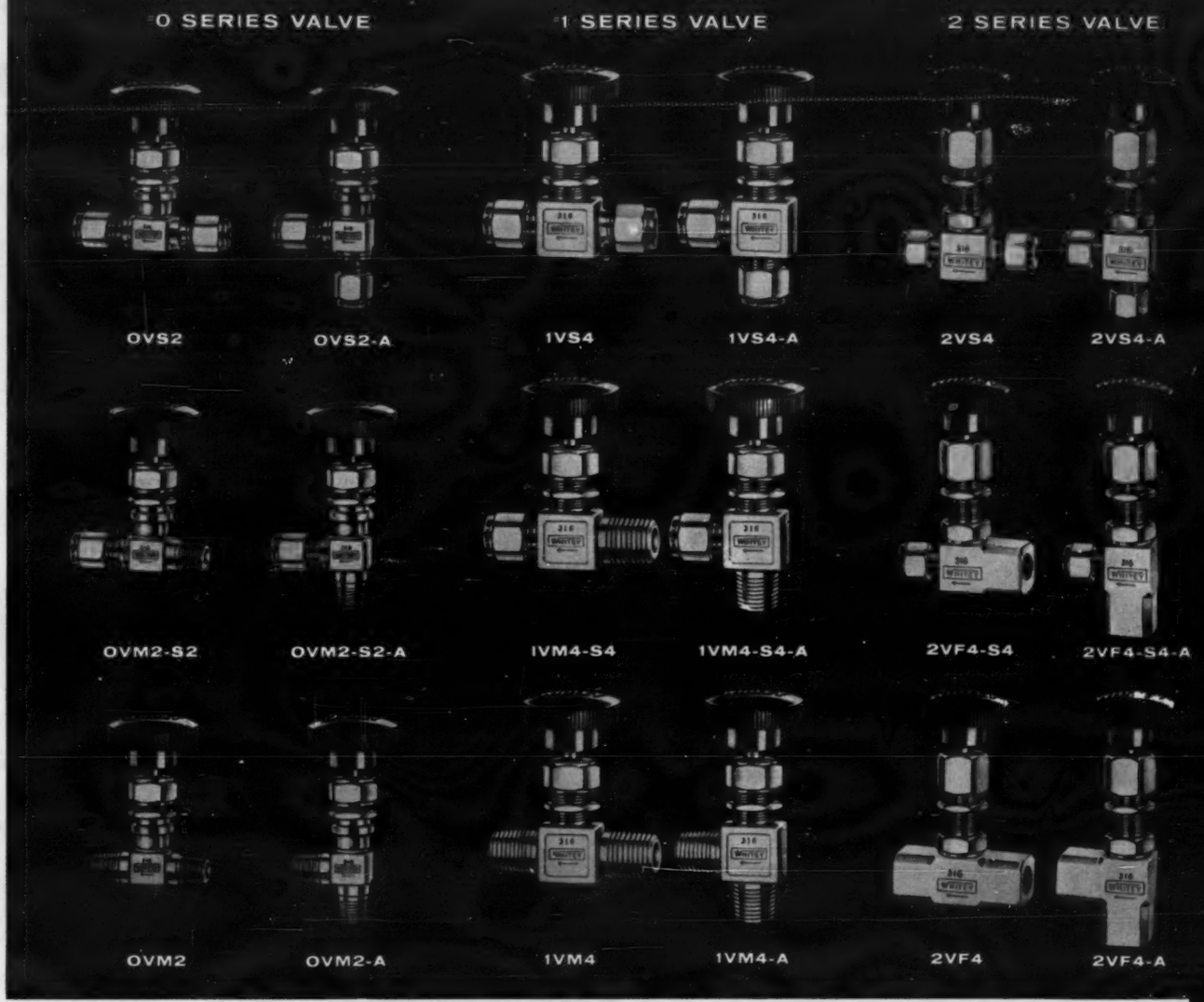


The No. A99 super-fine, midget, diagonal cutter has a "full flush maximum" cut designed to shave solder and cut extended leads. Slim head allows working in confined areas around circuit boards. Illustration shows the plier in use on an electronic filter. The plier has cushion grips and is obtainable with or without spring.

R. N. Hunter Sales Co., 9851 Alburtus Ave., Santa Fe Springs, Calif.

Circle 74 on Reader-Service Card

WHITEY MINIATURE VALVES



WHITEY Research Tool Co. manufactures a complete stock of small valves designed for instrumentation work or any application demanding flawless performance in fluid or pneumatic systems.

The WHITEY Valves above illustrate some of the wide variety of connections available in ⅛" and ¼" pipe and tube sizes. These valves are stocked locally by your WHITEY Distributor.

In answer to customer demand, all WHITEY Valves through ½" size are available with Swagelok Tube Fitting Connections to facilitate ease of installation and positive, leakproof performance. Male and female pipe connections through ½" size are also available.

Panel mounting; Teflon* cylinder packing; micro-regulating and non-regulating stems are standard features on all WHITEY Valves.

For color coding purposes, colored handles may be specified when ordering WHITEY Valves.

*Dupont

Complete technical data on WHITEY Valves available on request

FOR EXACTING SERVICE — WHITEY

WHITEY RESEARCH TOOL CO. • 5525 MARSHALL STREET • OAKLAND 8, CALIFORNIA

Toggle-Action Plier 360



Featuring long, easy-to-use handles, the Series P-1600 plier is designed to apply a clamping force of 1600 lb at spindle on application of normal hand pressure. The device may be obtained with a throat depth of 2-1/4 inches and throat gaps of 1-3/16, 3, 4 and 6 inches. Manufactured from steel forgings, the plier is heat-treated and cadmium-plated.

Lapeer Mfg. Co., 3053 Davison Rd., Lapeer, Mich.

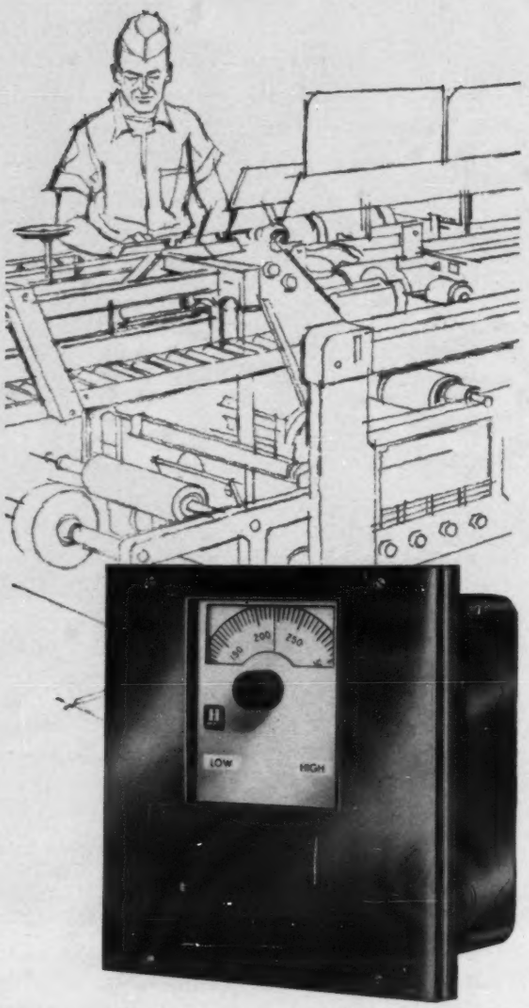
Radiation Monitor 361



A flashing light and an audible signal from this device gives an early warning of unexpected gamma or beta rays. The "Monitor" operates on a 4v mercury battery which provides a month of steady use. Determinations of absolute intensity of radiation falling within the acceptable dynamic range are limited to establishing the order of magnitude. Warning signals given by the device are proportional to radiation intensity—monitor is always "on". Source of radiation may be located or the best evacuation route may be chosen. The atomic worker does not have to read a meter, check a counter or carry cumbersome detecting instruments. Pocket-sized monitor (3/4 by 5-5/8 inches) is carried easily in shirt pocket, and weight with battery is only 3.4 oz.

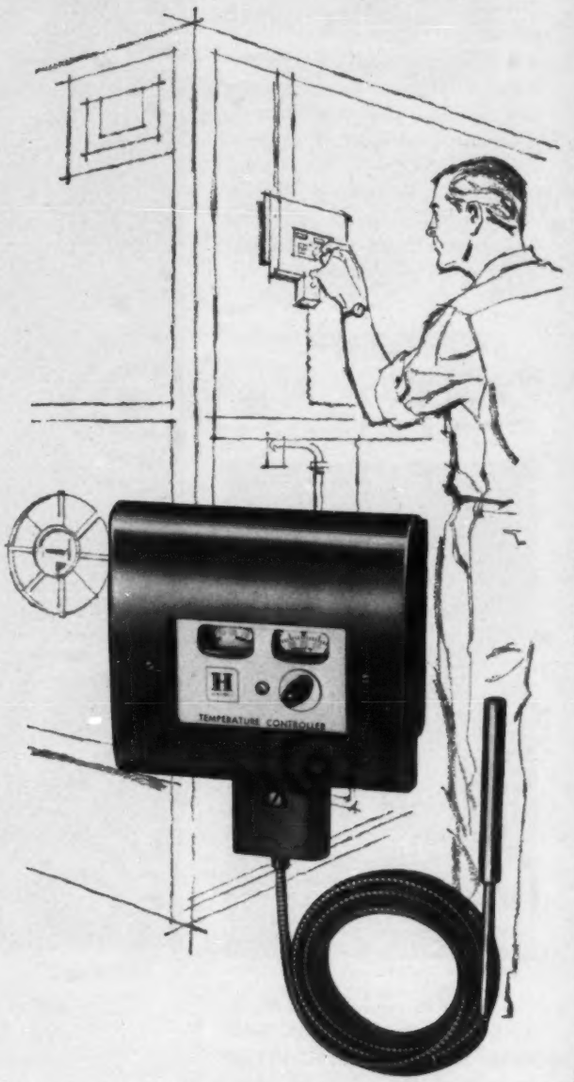
Elgin Laboratories, Inc., Div. of Erie Resistor Corp., Waterford, Pa.

Whether you choose by specification, price or both... **There's a Honeywell pressure control**



☐ **For precise control at low cost—R7086—R7087**

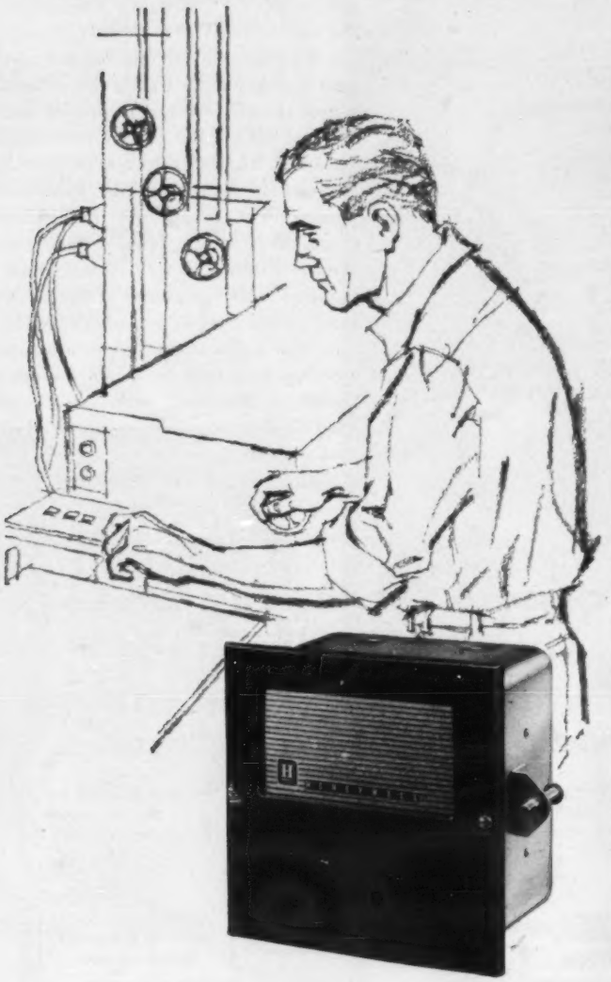
Temperature controllers for use wherever precision temperature control must be maintained. Ranges from −150° to +3000° F. are possible. R7086 uses thermocouple, R7087 uses resistance bulb. Both, surface or flush mounted. R7086 $150.00; R7087 *only $120.00.*



☐ **For accurate control with indication at low cost**

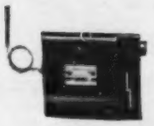
T654A indicates and controls temperatures on an evenly graduated scale accurate within 1% of scale range. This switch can control an *Actionator**, motor, relay, contactor or other device. Completely compensates for ambient temperature changes. Ranges from −150° F. to 1200° F.

temperature or to fit your exact needs!

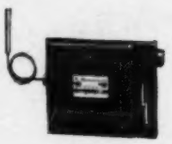


Whatever your application, you'll find the control that suits you best in Honeywell's complete selection

P444
For industrial applications that call for independent high-pressure and low-pressure settings and switching action. Adaptable for surface or flush mounting.



T444
For a wide variety of industrial applications requiring independent high-temperature and low-temperature settings and switching action. Adaptable for surface or flush mounting. Ranges from 0° F. to 660° F.



P428
For general industrial applications requiring the control or limiting of relatively high pressures. Models are made with explosion-proof case for hazardous locations. Ranges from 30 PSI to 5000 PSI.



T667
Designed for use as a remote-bulb temperature controller. SPDT switching provides temperature control in heating, cooling, or heating-cooling commercial and/or industrial applications. Ranges from −150° F. to 1200° F.



*Trademark

☐ For reliable control at minimum cost—VERSA-TRAN

This inexpensive controller is completely transistorized. Needs no tubes, no warm-ups . . . gives instant reaction. Works with sensors that can be thermisters, probes, resistance bulbs, pressure transducers or humidity elements. Available in various temperature, humidity and pressure ranges. *Standard models as low as $39.50.* Model shown above only $49.50.

Write Honeywell, Minneapolis 8, Minn.

HONEYWELL INTERNATIONAL Sales and service offices in all principal cities of the world. Manufacturing in United States, United Kingdom, Canada, Netherlands, Germany, France, Japan.

Honeywell

First in Control

SINCE 1885

Phono Adapter Kit 362



Consisting of the 11 most frequently used audio adapters and one "universal-application" molded interconnecting cord, the No. 331A adapter kit solves many problems of connecting two pieces of equipment that do not have matching connectors. The kit saves time, eliminates "make-shift" connections, avoids soldering and provides a neat connection.

Switchcraft, Inc., 5555 N. Elston Ave., Chicago 30, Ill.

Citizens Band Transceiver 363



This all-transistor, pocket-sized citizens band radio transceiver measures just 5-1/4 by 2-3/4 by 1-3/16 inches. It has a 46-inch telescoping antenna and a high-impact case. Super-heterodyne circuitry provides greater sensitivity and high selectivity. The unit is complete with earphone, shoulder strap and one set of crystals installed.

Raytheon Co., Distributor Products Div., Unicenter, Westwood, Mass.

Circle 75 on Reader-Service Card for more information



"That new Hamilton drafting table makes our old equipment really seem obsolete!"

NEW Hamilton torsion AUTO-SHIFT

Here is a drafting table that combines truly imaginative engineering with intimate knowledge of *today's* drafting procedures. Exclusive new torsion bar mechanism permits smooth, silent *fingertip* adjustment of board tilt. Simple counterbalance adjustment compensates for weight added to board in the form of drafting machines and lamps. *Flexible reference facilities* may be used from either side of desk. In addition, *space economies of up to 35% are possible!*

Write today for full details on the revolutionary new Hamilton Torsion Auto-Shift. Ask for Catalog ADR-623.



New freedom from fatigue is built into this table.

This Torsion Auto-Shift is a table you can adjust to meet any and every drafting need—and do it with effortless finger-light action.

Hamilton
PROFESSIONAL AND SCIENTIFIC FURNITURE

New Dimensions in Time and Space Efficiency for physicians; dentists; industrial, hospital, school laboratories; draftsmen; printers; libraries; home laundries.

Hamilton Manufacturing Company, Two Rivers, Wisconsin

Circle 76 on Reader-Service Card for more information

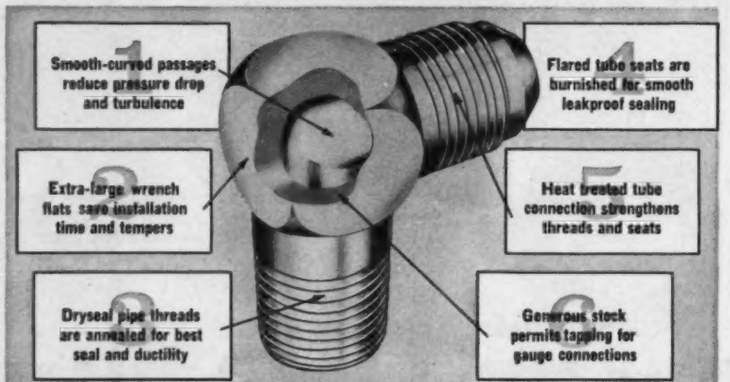
Optical Comparator 364



This precision optical tool is designed to measure dimensions as fine as 0.0025 inch. Called a "Mirroptic Comparator", the unit consists of a die-cast aluminum frame housing a reflective mirror of the beam-splitter type. Use of the reflective mirror permits the reticle to be visually but not physically superimposed upon the work. This reduces reticle wear and allows the user to mark the work while measuring it. Five-power magnification is provided by the lens. A shockproof, scratch-resistant, acrylic plate supports the part to be measured at the desired focal plane. Reticle is made of "Mylar"-type film and is suggested for measuring parts up to 1 inch in length for proper thickness, diameter, radius and length. Two blank reticle discs are supplied with each comparator. Weight is 4oz.

National Tool Co., Div. of National Cleveland Corp., 11222 Madison Ave., Cleveland 2, Ohio.

6 reasons for buying L&L hydraulic flared tube and pipe thread fittings



Because L & L brazes together standard machined bar stock components to make their fittings, you get more standard styles and sizes and faster service on specials.

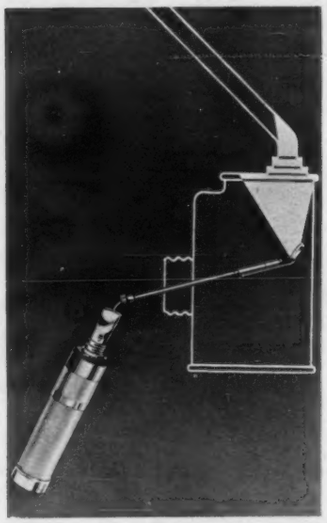
L and L Manufacturing Company
21590 Hoover Road • Warren, Michigan

DISTRIBUTORS IN PRINCIPAL CITIES

Circle 77 on Reader-Service Card for more information

Bore Inspection Light 365

A rotating mirror mounted at the end of a shaft below the illuminating lamp of this unit allows inspection of walls of bores with a minimum diameter of 3/4 inch. The mirror is mounted at a 45-deg angle to the line of shaft to provide right-angle vision. It is rotated easily through a full 360 deg by a knurled collar at the proximal end of the shaft. Standard model No. 404 has a shaft length of 8 inches with longer lengths obtainable on special order. Power source



may be regular flashlight dry cells or rechargeable batteries, or transformers from 110 to 220v a-c. Light attaches with a rigid bayonet joint. The range of uses other than bore inspection includes checking electrical and mechanical connections in enclosed installations without having to remove panels.

Welch Allyn, Inc., 168 Jordan Rd., Skaneateles Falls, N.Y.

Circle 78 on Reader-Service Card

FREE THIS VALUABLE BOOKLET



Packed with 24 pages of data on new ways to more economical more productive Fluid Power!

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You can use Boosters to particular advantage in:

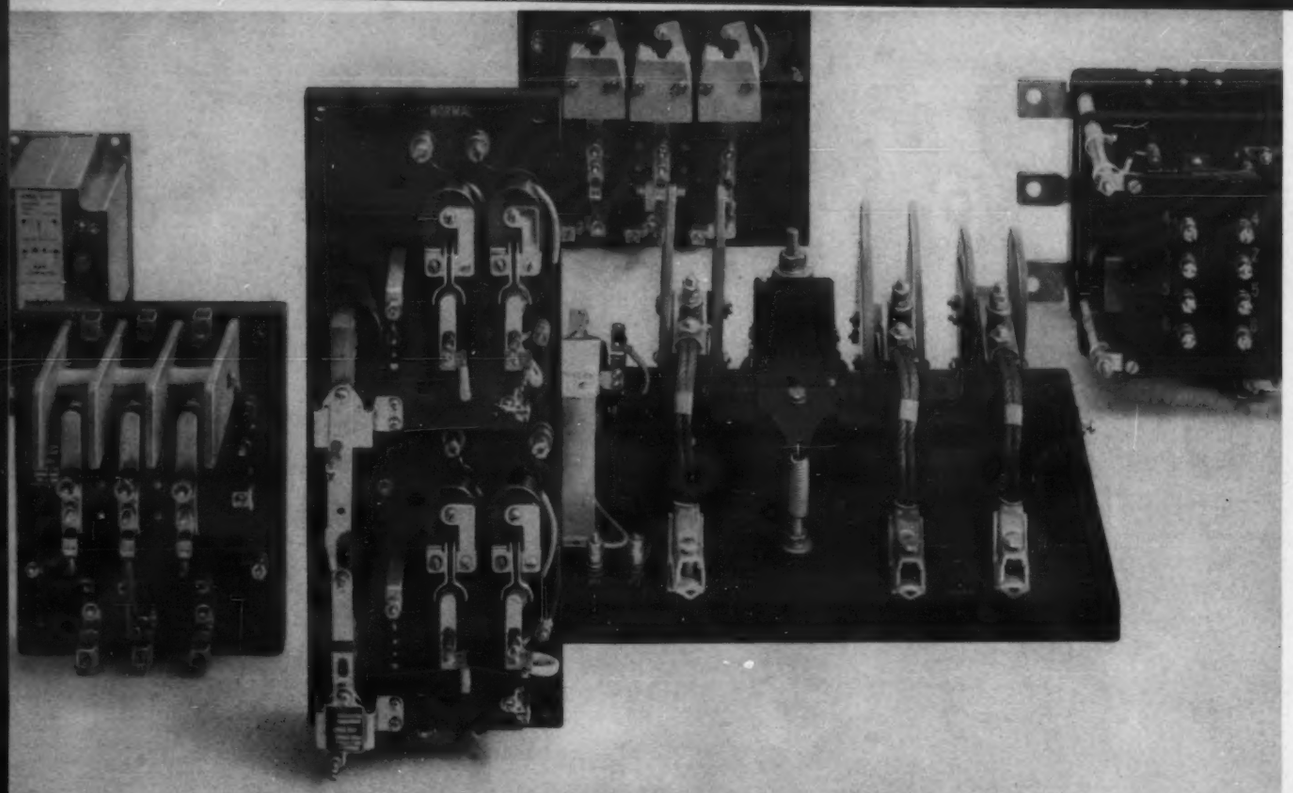
Pressing	Stamping
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For prompt personal service, call our Engineering Dept. at Porter 6-3400 Bensenville, Ill. Call "collect," person to person (at our expense).

Exactly how do Boosters save space, weight, air, cut costs, increase efficiency, reduce maintenance? How do they provide smooth hydraulic power (up to 10,000 psi or more) from your shop air and maintain pressure without heat generation or additional power consumption? Exactly how and where are they now being used? The whole absorbing story is told in color—along with full information on available models, dimensional data, pricing, etc.—in this new interesting booklet specially prepared for busy, time-short designers, engineers, and production men. *Write today for your free copy.*

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DIVISION OF FLICK-REEDY CORPORATION
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IS THAT "SPECIAL" CONTACTOR YOU NEED A "REGULAR" AT ASCO?

The tremendous variety of "regular" contactor designs produced by ASCO is the outgrowth of unequalled experience in the engineering of "special" control mechanisms. While this know-how *can* be put to work to resolve your unusual control problem, chances are that the solution is already on an ASCO shelf.

Often a slight modification of one of the many versatile ASCO designs will perfectly adapt it for performance to your most stringent specifications. All ASCO Magnetically Held Contactors are designed for flexibility to permit unusual contact materials, uncommon multipole contact arrangements, ac and dc arrangements, and a host of other engineered-to-fit features.



Is your requirement sustained low contact resistance? High interrupting capacity? Must your contactors close against transformer inrush currents of 30 times steady state? Do you require insulation for high voltage with cold switching?

ASCO Contactors meet these problems and many others. Contactors are available to 2000 amperes, 600 volts ac or dc.

Catalog 57-S3, available on request or from your local ASCO representative, illustrates many unusual Magnetically Held Contactors. One of these "regulars" may meet your needs precisely.

ASCO Electromagnetic Control ASCO

DEPENDABLE CONTROL BY Automatic Switch Co. 560 HANOVER RD., FLORHAM PARK, N. J. • FRONTIER 7-4600 • AUTOMATIC TRANSFER SWITCHES • SOLENOID VALVES • ELECTROMAGNETIC CONTROL

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EQUIPMENT

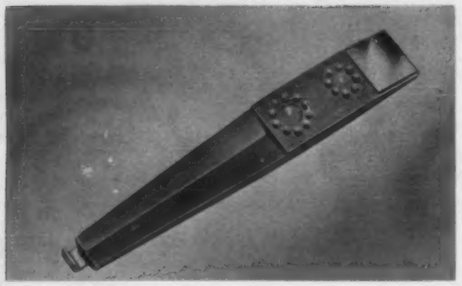
Portable Flexible-Arm Lamp 366



"Multi-Lamp" is designed for laboratory, bench and machine-tool lighting and features a snap-on "button" mounting bracket. Buttons may be attached to any desired support or surface. The lamp combines advantages of a portable lamp with stability of a permanent fixture. Design of lamp head provides air cooling and shade resists heating. Accommodating bulbs to 100w, "Multi-Lamp" is fitted with a special spun-aluminum reflector which produces nonglare illumination and is 30 percent more efficient. Equipped with nylon and ball-bearing fittings at both ends, the unit has a heavy-duty flexible neck jacketed with polyvinyl and an impact-resistant molded phenolic shade. Offered in standard black, lamp may be obtained in other colors on special order. A choice of right-angle or straight base is offered. Neck length is 12 to 24 inches.

Moffatt Products, Inc., 3124 N. Washington, Minneapolis 11, Minn.

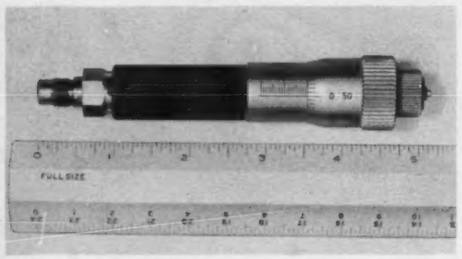
Tube-Pin Straightener 367



A repair tool for straightening bent radio and TV tube prongs is molded in one piece from "Cycolac" (a rigid, heat-resistant polymer). A metal tube puller is molded in at one end of the device and an inspection mirror is on the opposite end. Slots provide straightening of both seven- and nine-prong tubes. "Hi-V Tube Tool" No. 101-T weighs less than 1 oz and is only 5-1/8 inches long. Clip affixed to back of tool allows easy carrying in shirt pocket. Tool's glossy surface is not scratched easily.

Marbon Chemical Div. of Borg-Warner Corp., Washington, W. Va.

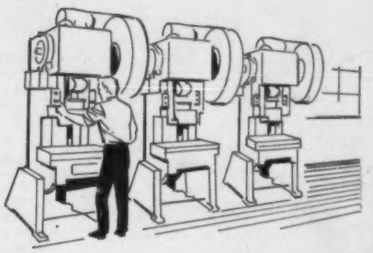
Cylinder Pressure Gage 368



Designed to accurately measure peak compression and combustion pressures in high-speed diesel engines, this pocket-sized gage consists of a differential piston and cylinder. Pressure to be measured is opposed by a spring force which varies with the setting of the micrometer thimble. The piston travel, about 1/64 inch, is transmitted to a plunger projecting from the end of the micrometer thimble. Indicator is preset to a reading in excess of the peak pressure to be measured. Micrometer thimble is rotated in the direction of decreasing pressure, until the peak pressure equals the setting of the gage. Readings are displayed on a micrometer-type scale which is graduated from 0 to 2000 psi in increments of 2.

Kistler Instrument Corp., 15 Webster St., North Tonawanda, N.Y.

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LAMINA-BRONZE

WEAR PLATES

Lamina
DIES AND TOOLS, INC.
P.O. BOX 31, ROYAL OAK, MICHIGAN
Phone: JOrdan 6-8711

Lamina-Bronze Wear Plates and their use are more completely described in Bulletin WP-59, send for your free copy.

The ram guides of this Bliss press utilize Lamina-Bronze (electroplated bronze on steel) wear plates to assure long life and free-running. For all models in the "C" series of inclinable presses, Bliss has standardized on Lamina-Bronze V-Gibs. In like manner, Lamina-Bronze wear surfaces are the best answer for any part that requires the non-seizing properties of bronze and the strength of steel.

Circle 80 on Reader-Service Card for more information



WHO MAKES GEARMOTORS THIS SMALL?

Globe Industries makes d.c. (and a.c.) gearmotors this small to make your design more compact, reliable and salable. If you need an exact speed-torque combination in a precisely engineered package, look at these 4:

TYPE VS—Motor is 7/16" flat, develops .0025 hp @ 8,000 to 17,000 rpm, and can use our standard modular spur gearing in 62 ratios. Continuous duty torques to 35 oz. in. available. Gear box can be side mounted (as shown) or end mounted with a frontal area of only 0.4 square inch.

TYPE SS—a 7/8" diameter d.c. motor that develops .004 hp @ 8,000 to 17,000 rpm. Compatible gearing system has 21 planetary ratios or 28 spur gear ratios. Continuous duty torques available to 300 oz. in. Governors, brakes and filters designed to meet MIL specs also.

TYPE MM & LL—Most widely used 1 1/4" diameter precision miniature motors and gearmotors in the world. Choose from 101 standard planetary ratios; torques to 1000 oz. in. Because these and other Globe motors have many standard armature windings, it's easy to get the exact speed-torque combination you need. Motors to .015 hp @ 6,000 to 15,000 rpm.

TYPE BD & BL—1 1/2" diameter d.c. motors with planetary gearing in 22 ratios. Unit illustrated provides up to 100 in. lb. continuous duty. With a 3" final stage, continuous duty torques to 500 in. lb. (1000 in. lb. intermittent) are available. These can replace units 5 times their size and weight. Motors to .033 hp @ 4,000 to 10,000 rpm.

Delivery is prompt; cost is reasonable. For details about d.c. and a.c. gearmotors request bulletin GGM from Globe Industries, Inc., 1784 Stanley Avenue, Dayton 4, Ohio.

GLOBE INDUSTRIES, INC.

PRECISION MINIATURE MOTORS. GEARMOTORS. TIMERS. ACTUATORS. CLUTCHES. BLOWERS. MOTORIZED DEVICES

GLOBE

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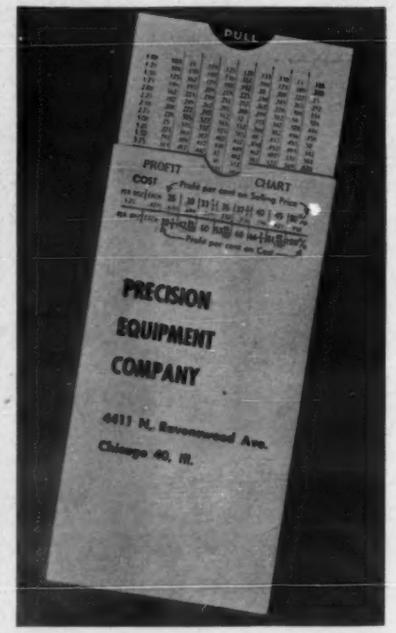
EQUIPMENT

Sound Meter 369

Measuring only 2 by 3 by 6 inches, the Model 450 sound meter can be held in the palm of a hand. It weighs only 2 lb and is operated on an ordinary 22.5v battery with an operating life of 30 hr. The meter has an exceptionally wide range of operation—from 35 to 142-db sound level range and a 40 to 8000-cps response. Completely transistorized, the meter has a heavy-gage aluminum case and a Rochelle salt diaphragm-type microphone. Direct-reading scale minimizes reading errors.

H. H. Scott, Inc., Instruments Div., Dept. P, 111 Powdermill Rd., Maynard, Mass.

Profit Chart 370



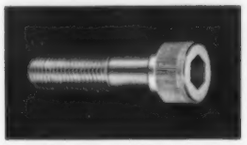
An automatic device provides a means of figuring profits or establishing a selling price speedily and accurately. Operation of the chart is simple. User may estimate profit on cost even though he does not wish to establish a selling price. Complete instructions are included with each chart.

Precision Equipment Co., 4111 N. Ravenswood Ave., Chicago 40, Ill.

Circle 82 on Reader-Service Card

Quick, easy way to get full information on SPS fasteners

Alloy or stainless . . . normal or critical application . . . there is an UNBRAKO socket head cap screw to meet virtually any need. Incorporating the most recent design advances, these cap screws are standard with UNBRAKO. Specify them for high reliability.



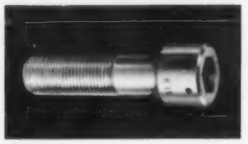
UNBRAKO pHd with Hi-Life thread

- pHd head means up to 2½ times as much holding power
- Hi-Life thread means increased fatigue life up to 100%

For literature, check ☐

Also stainless UNBRAKOS for corrosion-resistant fastening from −300° to 800°F.

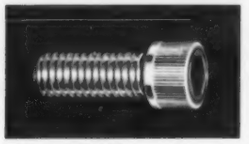
For literature, check ☐



UNBRAKO K 16

- Replaces costly specials in critical applications
- 300% more fatigue life than any other standard cap screw
- Threads rolled and fillet area cold-worked after heat treat

For literature, check ☐



UNBRAKO KS 812

- The only stainless socket screw with certified minimum tensile—125,000 psi
- Made of high-grade austenitic stainless hardened through cold working
- pHd head, Hi-Life thread

For literature, check ☐

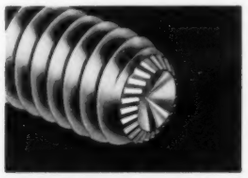
Name_____ **Title**_____

Company_____

Address_____

City_____ **Zone**____ **State**____

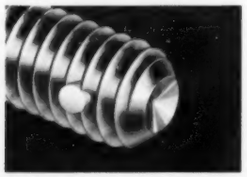
All UNBRAKO High Torque Set Screws, regardless of point type or locking method, have tightening torques as much as 40% higher than those for ordinary set screws, thanks to deeper sockets, fully formed threads, and precision heat treatment to eliminate brittleness and decarburization.



UNBRAKO Knurled Cup Point

- Self-locking—won't work loose even in poorly tapped holes
- 5 times as vibration resistant as closest competitor
- For quick and permanent location of gears, collars and pulleys on shafts

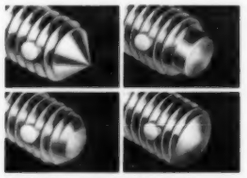
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UNBRAKO Plain Cup Point with Nylok®

- Self-locking, whether seated or not, owing to resilient nylon pellet
- For use against shafts too hard for knurled cup point to bite into, or where fine adjustments must be held

For literature, check ☐



Other UNBRAKO Points

- Cone and half-dog—for permanent location of parts
- Flat and oval—for frequent resetting

To build in a guarantee of locking, order the Nylok feature for all set screws except knurled cup point

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®T.M. Reg. U.S. Pat. Off., The Nylok Corp.

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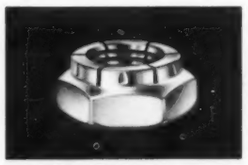
The simple answer to all locknut needs, FLEXLOC Self-Locking Nuts are one-piece, all-metal fasteners that lock positively on screws, studs, etc., wherever wrenching stops . . . without aid of wires, lockwashers, cotter pins or nonmetallic inserts. For miniaturized assemblies, specify microsize FLEXLOCS.



Full Height FLEXLOC

- High reliability in wide range of uses, especially where high tensile strength is required. Also in microsizes
- Like all FLEXLOCS, repeatedly reusable without loss of locking power

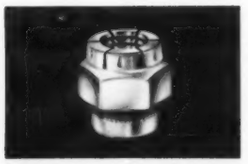
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FLEXLOC Thin Nut

- 30% lower and lighter than full height nut
- Designed primarily for shear applications
- Meets AN tensile spec for full height locknut

For literature, check ☐



FLEXLOC Clinch Nut

- Quickest, easiest way to put self-locking threaded holes in thin-section materials; invaluable for blind mounting. Also in microsizes
- Knurled shank is pressed through hole in sheet material, then punched, rolled or swaged over

For literature, check ☐

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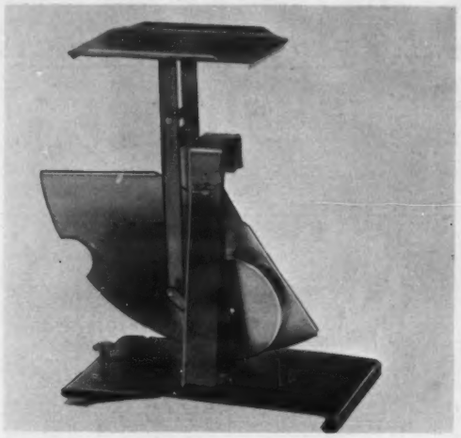
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STANDARD PRESSED STEEL CO.
JENKINTOWN, PA.

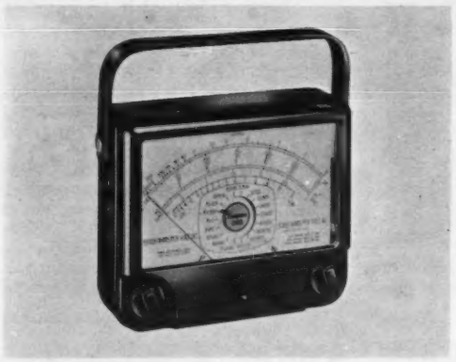
Gram-Ounce Scale 371



This versatile scale is suited for lab and industrial uses which require a low-cost unit with high accuracy. Made of polished stainless steel and aluminum, the scale is calibrated in ounces from 0 to 16 and in grams from 0 to 450. Weighing pan is 3 by 2-1/4 inches and the scale stands 5-3/4 inches high.

Edmund Scientific Co., Barrington, N.J.

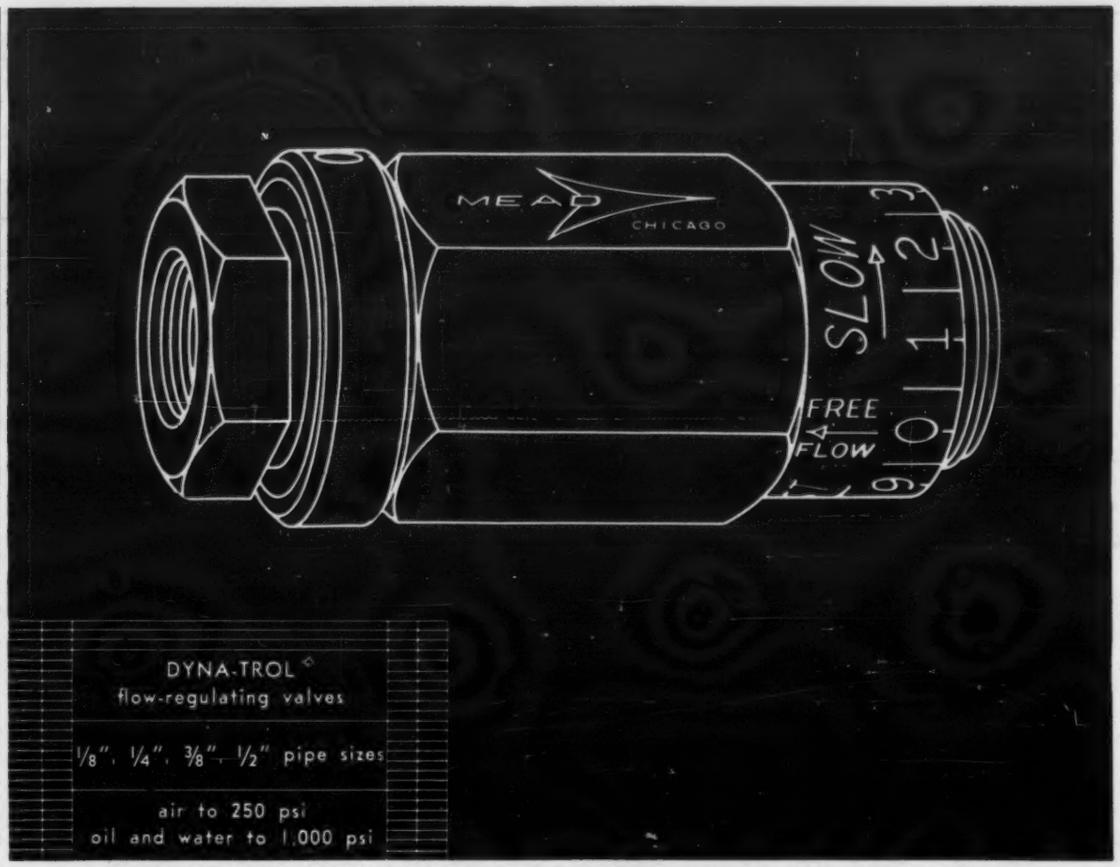
7-Inch Scale VOM 372



Ideal for radio and TV service work, Models 267 and 268 volt-ohm-milliammeters feature low micro-amp ranges (0 to 50 for Model 267 and 0 to 60 for Model 268) and less circuit loading. Sensitivity of a-c voltage ranges to 5000 ohms per volt. One major switch in the tester selects range position and function simultaneously. Large, easy-to-read, 7-inch meter completes the unit's usefulness in general laboratory work, general industrial applications and production-line testing where accurate repetitive readings are required.

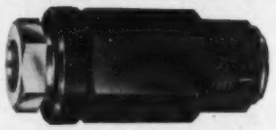
Simpson Electric Co., 5200 W. Kinzie St., Chicago 44, Ill.

Circle 82 on Reader-Service Card



PROBLEM: how to replace a 1/4" valve with a less-costly 1/8" valve (and get extra precision in low-flow ranges)

SOLUTION: NEW MEAD DYNA-TROL VALVE



Check these design advantages of the new MEAD DYNA-TROL flow-regulating valve:

- Adjusting sleeve — easily rotated by hand — locks to any setting and cannot be accidentally removed from valve body
- Calibrated sleeve records settings for future reference
- Knife-edge variable orifice reduces flow distortion caused by viscosity changes in working medium
- No internal springs to cause malfunction
- All parts rust-proof
- Wide operating range: −40° F. to +250° F.

Small, economical MEAD DYNA-TROL flow-regulating valves can replace more costly valves of larger pipe size. Reason: Internal design permits pneumatic or hydraulic flow equal to full pipe area in both directions. The first 360° turn of the adjusting sleeve increases flow from zero to about 10% of potential — a new measure of precision in low-flow ranges. Successive turns accurately reach 100% of pipe capacity. To cut costs and give exacting control to piston speeds, specify MEAD DYNA-TROL valves to solve your flow regulating problems. For information on quick delivery, write to MEAD *today.*

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ASK YOUR MEAD MAN for more dollar-saving automation ideas

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GAGE PAGE

A Quick Run-down of New Gaging Ideas



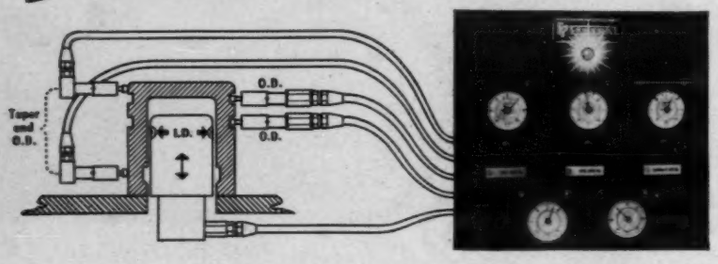
THE MOST PRACTICAL WAY

. . . to check dimensional relationships such as hole location, taper, center distance, etc., is to gage with Air.

The FEDERAL Air Gaging System combined with electric control does the job rapidly . . . embraces complete selection of building-block components . . . measures inside and outside diameters, eccentricity and squareness — rapidly and economically . . . best system for otherwise inaccessible dimensions.

Cut multiple-dimension inspection time in half with Modular Unit readout . . . single master "good" light indicates at a glance all checks within tolerance . . . "over" and "under" lights for each out-of-tolerance dimension . . . individual meters for direct reading. Designed for panel mounting — each unit compact, self-contained and quickly replaceable.





For complete specs, dimensions — the *whole* story — send for Catalog 60 AM.



FEDERAL PRODUCTS CORPORATION
1486 EDDY STREET, PROVIDENCE 1, R. I.

Ask **FEDERAL**® *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic—for Inspecting, Measuring, Sorting, or Automation Gaging

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EQUIPMENT

Temperature Sensor 373



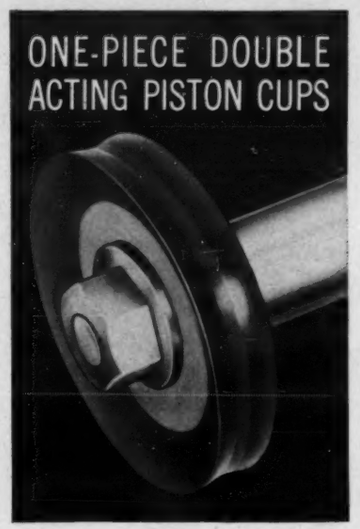
Model 177A temperature sensor for nuclear applications is designed to measure absolute or differential temperatures in the −70 to 300C range. The unit will withstand a radiation level of 500 rad/hr or a total exposure of 5 times 10^7 rad, 1 mev average. Suited for use in commercial thermowells, the device meets requirements of MIL-T-2867B, Type RM. Time constant is less than 5 sec for 63.2 percent of total resistance change when probe is plunged rapidly from room temperature into hot water moving at 3 fps. Sensing unit hermetically sealed in a "Monel K" shell and leads have braided fiber-glass insulation.

Rosemount Engineering Co., 4900 W. 78th St., Minneapolis 24, Minn.

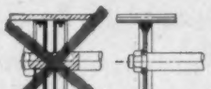
REDUCE COSTS, IMPROVE PRODUCT QUALITY!

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CHICAGO-ALLIS



For cylinders, pumps, and valves . . . air, water, or oil. This is a piston type double-cup packing in a single unit . . . specially compounded rubber is bonded to metal disc of brass plated steel or solid brass. Lips are designed to maintain uniform pressure on the cylinder walls, insuring constant sealing action. Serving the same purpose as far more complicated and expensive pistons, Chicago-Allis piston cups are simple in design, economical, and provide long life and dependable service.



Simplify design... use one piston type cup that replaces piston and two seals



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MFG. CORP.

129 N. GREEN ST. CHICAGO 7, ILL.

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less BOUNCE to the ounce



with Decco two-way shock-mounted industrial solenoids!

● **Highly resistant to moisture, quality-built from the best materials available—DECCO INDUSTRIAL SOLENOIDS, in compact AC and DC models, contain built-in, two-way, shock absorbing bumpers which prevent self-destruction, the greatest cause of solenoid failure.**

Unspent stroke force is absorbed by these cushioning bumpers, adding millions of strokes to the life of the solenoid.
DECCO offers a complete line of rugged, top-quality solenoids, from cool-running, multi-million cycle oil-immersed models to tiny miniatures.

There's a model to meet your every requirement. Special solenoids engineered to your needs.

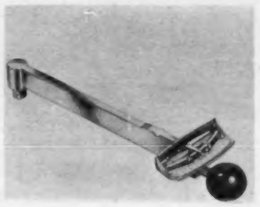
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EQUIPMENT

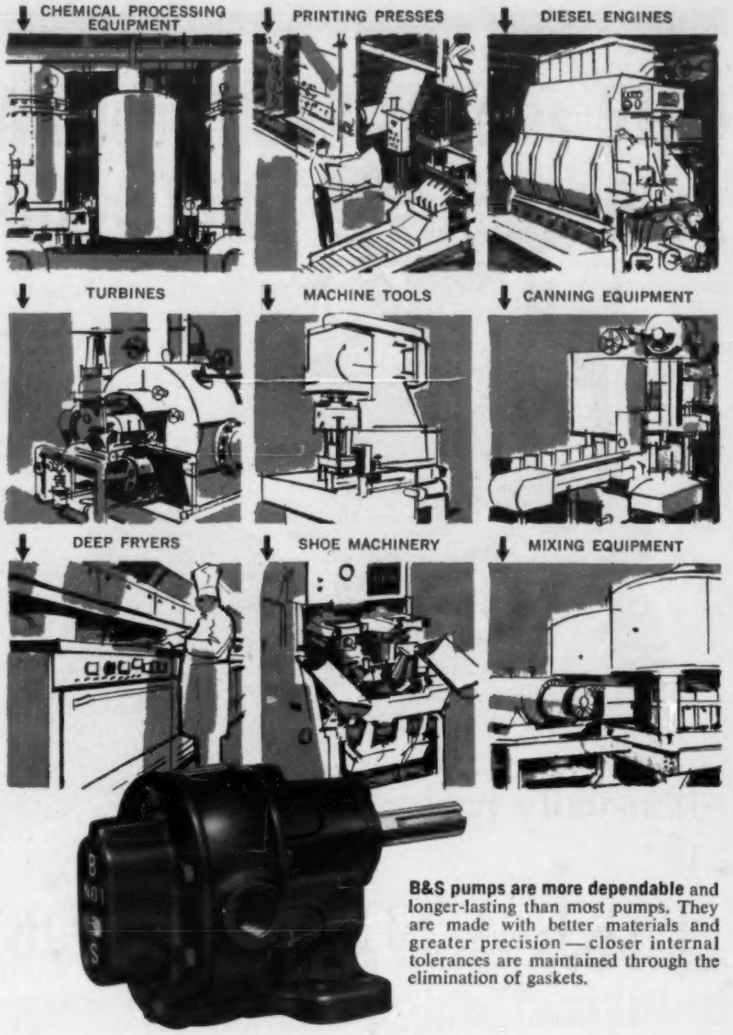
Visual/Audible 375 Torque Wrench

The Model S torque wrench is a measuring instrument for making mechanical checks of stress, strain, thrust, tension and compression where a record of the peak reading is desired. The unit is equipped with a "Sensory" signaling mechanism, eliminating the necessity of the operator's watching the indicator scale to obtain the reading at the moment of yield. Signaling mechanism functions entirely independent of the measuring element. The memory indicator is pushed along a track on the face



of the scale as torque is exerted. Mechanism sounds a distinct click, imparts a strong impulse to the hand the instant preset torque is applied, and the operator automatically releases his pull on the torque wrench. Memory pointer remains at peak torque exerted. Legible scale is readable from all working angles. Pivoted handle permits accurate torque control when wrench is used with adapters and extensions.

P. A. Sturtevant Co., Addison, Ill.



B&S pumps are more dependable and longer-lasting than most pumps. They are made with better materials and greater precision — closer internal tolerances are maintained through the elimination of gaskets.

See how a Brown & Sharpe Pump gets around!

You'll be amazed how often Brown & Sharpe "standard" pumps can take your "special" jobs in stride — at low cost — with little or no modification. For instance:

The popular Models 1, 2, 3, 4, 1S, 2S, 3S Rotary Gear Pumps are used for everything from acids, to oils, to molten lead. Suitable for pressures to 200 psi; cap., to 26.8 gpm; viscosities, 32 to 50,000 ssu. Available for foot or flange mounting; with or without integral relief valves. Before you pump anything . . .

Check B&S standard pumps first!

And if they won't do the trick, ask us about a special. Brown & Sharpe Mfg. Co., Providence 1, R. I.

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PRECISION CENTER

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It usually pays
to
TAKE A SECOND LOOK

. . . even at products which have long been considered "perfected".

The familiar crown cap, for example. Composition cork inserts have been used for nearly a century — more recently in combination with foil or coated paper. Now the advent of vinyl dispersions has brought about an exciting change in gasket design, and CHEM-O-SOL is playing an important part in it.

Dispensed into the crown shell as a liquid, CHEM-O-SOL takes shape under the light pressure of a metal die and fuses quickly with heat. Another version is uniformly distributed by centrifugal force and expands to a foam as it fuses. Less material does the same job, and it's applied in one operation instead of two. Sealing properties are excellent and delicate flavors are protected, too.

This is only one example. There are hundreds of other exciting possibilities for our CHEM-O-SOL coating, molding, and gasketing material. The CHEM-O-SOL brochure will help you to *take a second look* at your own products. Write Chemical Products Corporation, King Philip Road, East Providence, Rhode Island.

CP **CHEM-O-SOL**® THE MOST ADAPTABLE PLASTIC

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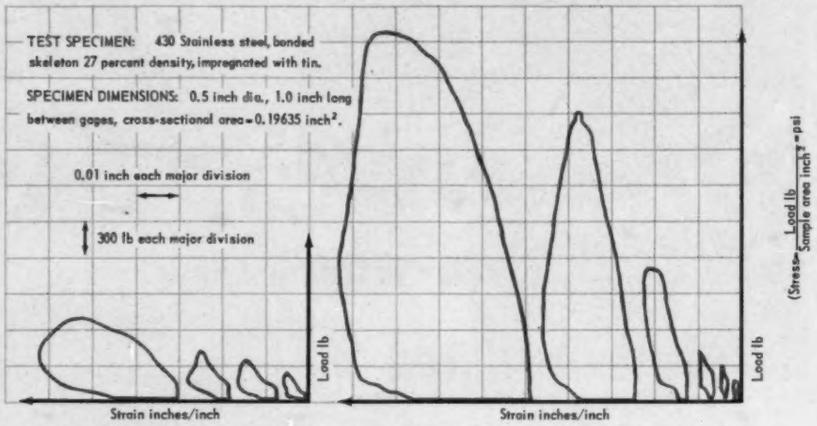
DESIGN NEWS — DESIGN IDEAS — MATERIALS

Fiber-Metal Seals Allow High Temperature-

Lars G. Soderholm, Midwest Editor

New high-temperature, high-pressure static seals use a sintered fiber-metal body with a softer metal filler. The fiber-metal body provides resiliency and locks the filler metal in place. The soft filler metal will conform to the seal face under pressure and provide leakfree service.

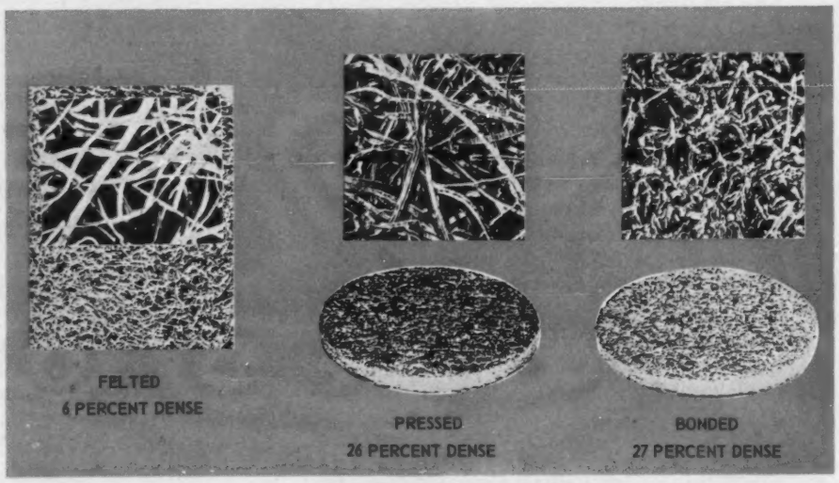
Initially developed for the U. S. Air Force, the high temperature-pressure static seals utilize fiber-metal skeletons made of molybdenum or stainless steel. The material is prepared from wools,



COMPRESSION AND RECOVERY MEASUREMENTS AT 572F TEMPERATURE

COMPRESSION AND RECOVERY MEASUREMENTS AT ROOM TEMPERATURE

COMPRESSION AND RECOVERY MEASUREMENTS of a specific fiber-metal seal show characteristics of material at room temperatures and 575F. At room temperatures high loads are necessary to compress seal. At elevated temperatures smaller loads result in equal compression.



SKELETON FABRICATION is shown in three steps. Initially, material is felted, then pressed to control density and then bonded by brazing or sintering.

Pressure Operation

wires or filaments that are chopped into small lengths. After degreasing, the fibers are shaken into a mold and pressed to a controlled density. After a sintering or brazing operation to bind the fibers at points of contact, the metal skeleton is ready. Filler material such as silver or indium is melted and impregnated into the skeleton in a sealed container, first in a vacuum and then under pressure of argon gas.

Two methods of securing shapes are being used. In one method the composite seal is machined. This works well when the filler is a metal. In cases where the filler is not a metal, the skeleton material is backed up by filling the voids with a soluble salt and then machined by itself. After machining, the salt is dissolved and filler material impregnated into the part.

Materials for the high-pressure, high-temperature seals have been tested up to 1200F and 5000 psi. In a test with cycling temperatures from 72F to 1000F, pulsating gases and pressures from 0 to 5000 psi, three complete temperature cycles failed to produce any trace of leakage. Hydraulic fluids were tested against a molybdenum-silver seal for 93 hr at 1000F and 336,984 impulse cycles again without any leakage.

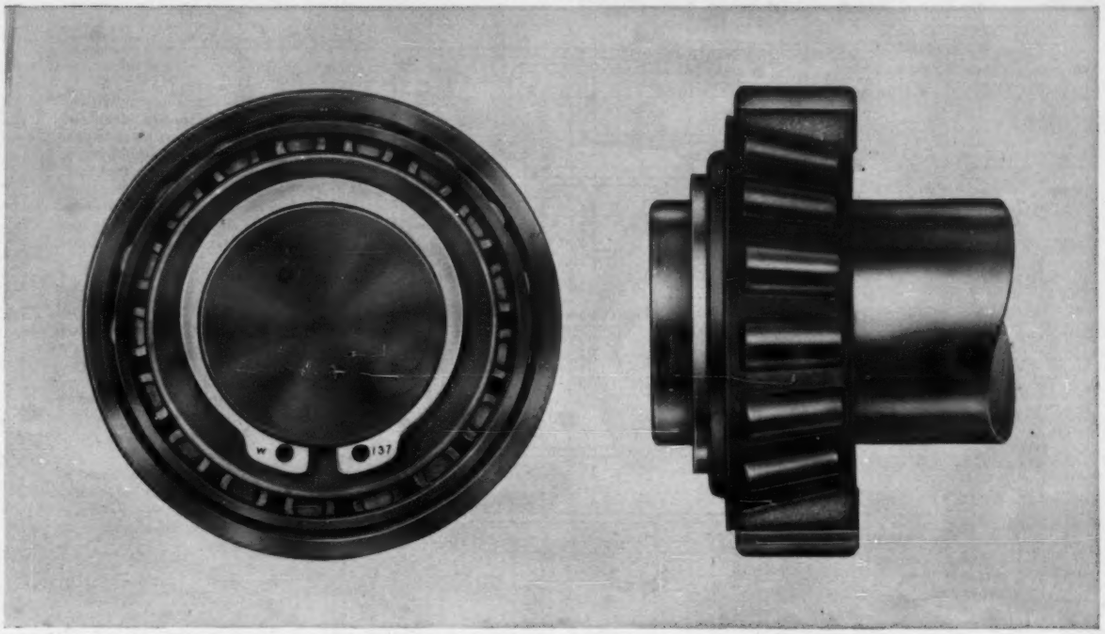
The composite fiber-metal static seals were developed by the Fluid Mechanics and Combustion Section of Armour Research Foundation, Chicago, Ill., for the Materials Central, Wright Air Development Div., U. S. Air Force.



"V" Ring made of molybdenum fibers, not bonded, 40 percent skeleton density, impregnated with silver

Gasket, 430 stainless-steel sintered fibers, 45 percent skeleton density. Not impregnated

NEW! Waldes TRUARC Series 5160 Heavy-Duty Retaining Ring



for thrust and impact...for retaining bearings ...for a new approach to heavy-duty fastening

Now you can enjoy the benefits of a truly heavy-duty fastener — with all of the advantages and production economies retaining rings provide. The new Truarc Series 5160 is a unique external ring designed to secure components on shafts, axles and similar structural members. It has high thrust load and impact resistance and forms a shoulder sufficiently high to retain parts having large corner radii or chamfers. The Series 5160 is ideal for retaining bearings. You can use it *without spacer washers* to secure ball bearings, tapered roller bearings (shown above) and cylindrical roller bearings — all having large corner breakouts. The ring eliminates the need for machined shoulders, costly heavy-duty nuts and other bulkier and more expensive fastening devices normally required for extreme loading conditions. The Truarc Series 5160 is available in 11 popular sizes for shafts ranging from .473" to 2.0" dia. — and other sizes are on the way. You can order the Series 5160 in carbon spring steel or — for corrosion resistance and high temperature limits — in Armco PH 15-7 Mo stainless steel. Sizes up to 1.378" also are available in beryllium copper. For complete specifications, write for Truarc Data Bulletin No. 459-11. Better yet, contact your local Truarc Representative or Distributor. They're listed in the Classified Telephone Directory under "Retaining Rings" or "Rings, Retaining."

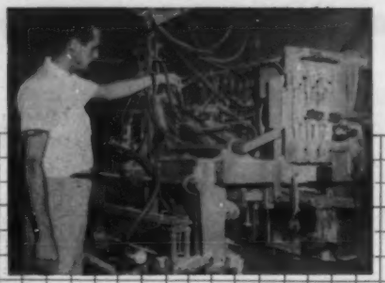
SEE FOR YOURSELF — Send for a free sample of the Truarc Series 5160 Heavy-Duty ring. We'll include a standard external ring of the same size for comparison. You'll see the difference as soon as you open the envelope!

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47-16 Austel Place, Long Island City 1, New York 61-1

WALDES TRUARC® RETAINING RINGS

Circle 89 on Reader-Service Card for more information

The Lane Furniture Company of Altavista, Virginia, broke its cedar chest production line into groups of operations for air-automation. One of the many circuits, shown here, was designed with quality Schrader components to brand the chest tops with a trademark, bore hinge recesses, and perform vertical and horizontal gang drilling operations. All three jobs are completed in less than 30 seconds!



1. Schrader air cylinder pulls gauge mechanism clear and releases finished piece to conveyor. Electrical RAISE signal comes from switch that indicates step 4 completed. As soon as completed piece is clear, another switch actuates LOWER coil of double solenoid valve.

2. Two cylinders set side clamp when electrical signal from switch on gate indicates that new piece has been conveyed into proper position.

3. Typical boring head is operated by pull-type single-acting cylinder. Electrical signal comes from switch on side clamp stop.

4. Individual cylinders apply branding heads. Cycle starts with side clamping. Length of branding cycle is controlled by electric timer.

MANUFACTURER AUTOMATES PRODUCTION LINE WITH SCHRADER AIR CIRCUITRY... COMPLETES 3 JOBS IN 30 SECONDS

If your plant has production lines too long, unwieldy and costly to compete effectively, take a tip: Break your entire manufacturing sequence into logical *groups* of jobs. Then develop air-powered and air-controlled machines to perform each group in sequence. This company did, and now has versatile, fast, and economical production. *You already have air.* Expand its uses with versatile Schrader Air Products and discover true efficiency.

There is a fully stocked Schrader Distributor nearby . . . staffed with experts to help you solve any air circuitry problem. Consult the Yellow Pages or write:

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468 Vanderbilt Avenue, Brooklyn 38, N. Y.

QUALITY AIR CONTROL PRODUCTS

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Load-Carrying Walls

E. J. Stefanides, Central States Editor

The body of a new refrigerated trailer is fabricated by an unusual manufacturing technique that sandwiches rigid insulation between plastic skins. This forms a one-piece seamless cargo cube. The resulting structure serves as both insulated cargo body and load-carrying frame, eliminating the need for external beam risers or chassis rails.

The body is formed of one-piece wall, roof and floor panels joined by epoxy resins to form a watertight, airtight cube. These panels are 40 ft long and 8 ft wide. They consist of continuous, epoxy-welded, balsa panels, 4 inches thick (5 inches for floor), laminated on both sides to fiber glass-reinforced polyester resin, approximately 1/16 inch thick. Balsa was selected for the insulation because of its high strength-to-weight ratio, low cost and low value of thermal conductivity ($K = 0.30$). Another factor considered was its closed-cell structure which is not easily permeated by moisture and does not collapse under heat.

Another unusual design feature is the method by which the undercarriage, refrigeration unit, king pin and retractable gear are fastened to the floor. These components are bolted to alumimum doubler plates equipped with threaded steel inserts which are bonded to the floor panel. Absence of through bolts, resulting from this construction, eliminates heat transfer points.

This type of trailer design solves two basic problems.

First, the stressed-skin laminate construction provides a strong light structure capable of taking shock loads encountered in service.

Second, the low value of thermal conductivity, absence of heat transfer points and sealing against air and moisture leakage reduce heat losses and heat load. The moistureproofing alone is said to eliminate the accumulation of 1500 lb of water, which in itself effects a considerable reduction in heat load.

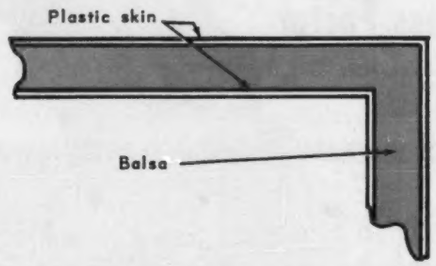
An additional advantage resulting from this construction is the total absence of body and chassis framing. This not only reduces the weight by an additional 1500 lb but also provides a 9 percent greater cargo volume.

This trailer is designed and manufactured by Perfection Div., Hupp Corp., Cleveland, Ohio.

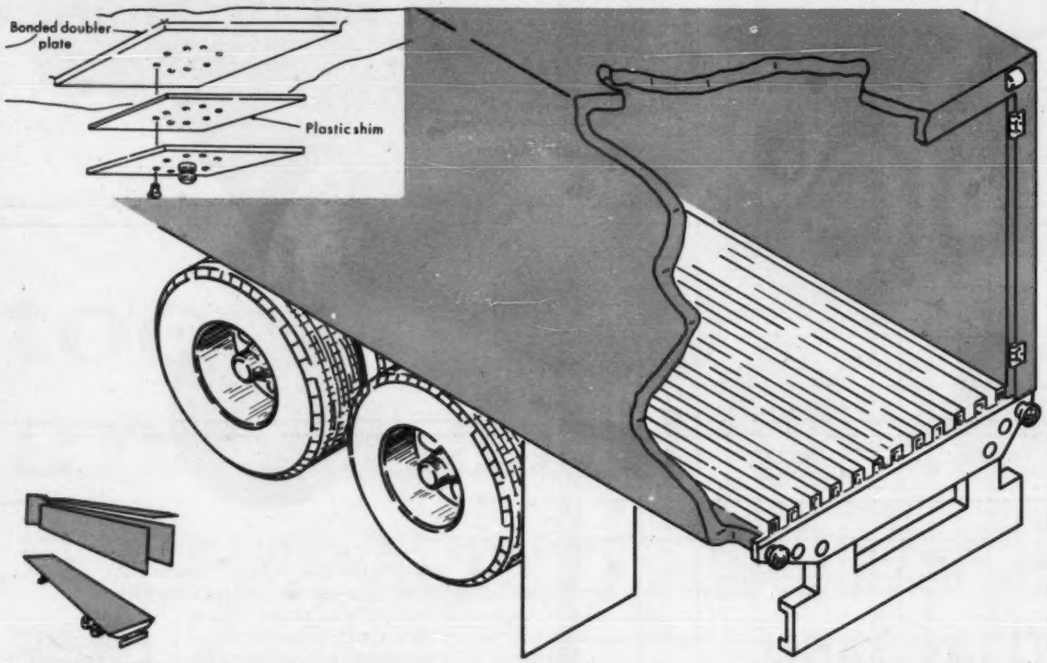
of Plastic-Skinned Trailer Eliminate Frame



REFRIGERATED TRAILER is designed for piggyback operation, conforms to new AFDOUS code and meets all highway load requirements.



STRESSED-SKIN PLASTIC LAMINATE SANDWICH consists of 4-inch-thick (5 inches for floor), continuous epoxy-welded balsa panel bonded on both sides to thin plastic skins. Stresses were well within 12,000 psi allowable working stress of plastic. Balsa strength which was not counted in calculation provides bonus margin of safety. Walls have sufficient column strength to allow full load to be hung from roof.



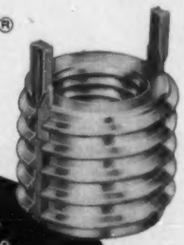
ONE-PIECE WALL, ROOF AND FLOOR PANELS are joined with epoxy resins to form watertight, airtight cargo cube. Light aluminum extruded floor provides air circulation beneath load. Beam across rear protects panel by absorbing energy of backup ramp impacts. Undercarriage, king pin and other underbody components are fastened to aluminum doubler plate bonded to skin. Aluminum plates were selected because coefficient of expansion is nearly that of plastic skin and because of high strength-weight ratio. Plastic shims between steel mounting plates of component and aluminum doubler plates prevent electrolytic corrosion.

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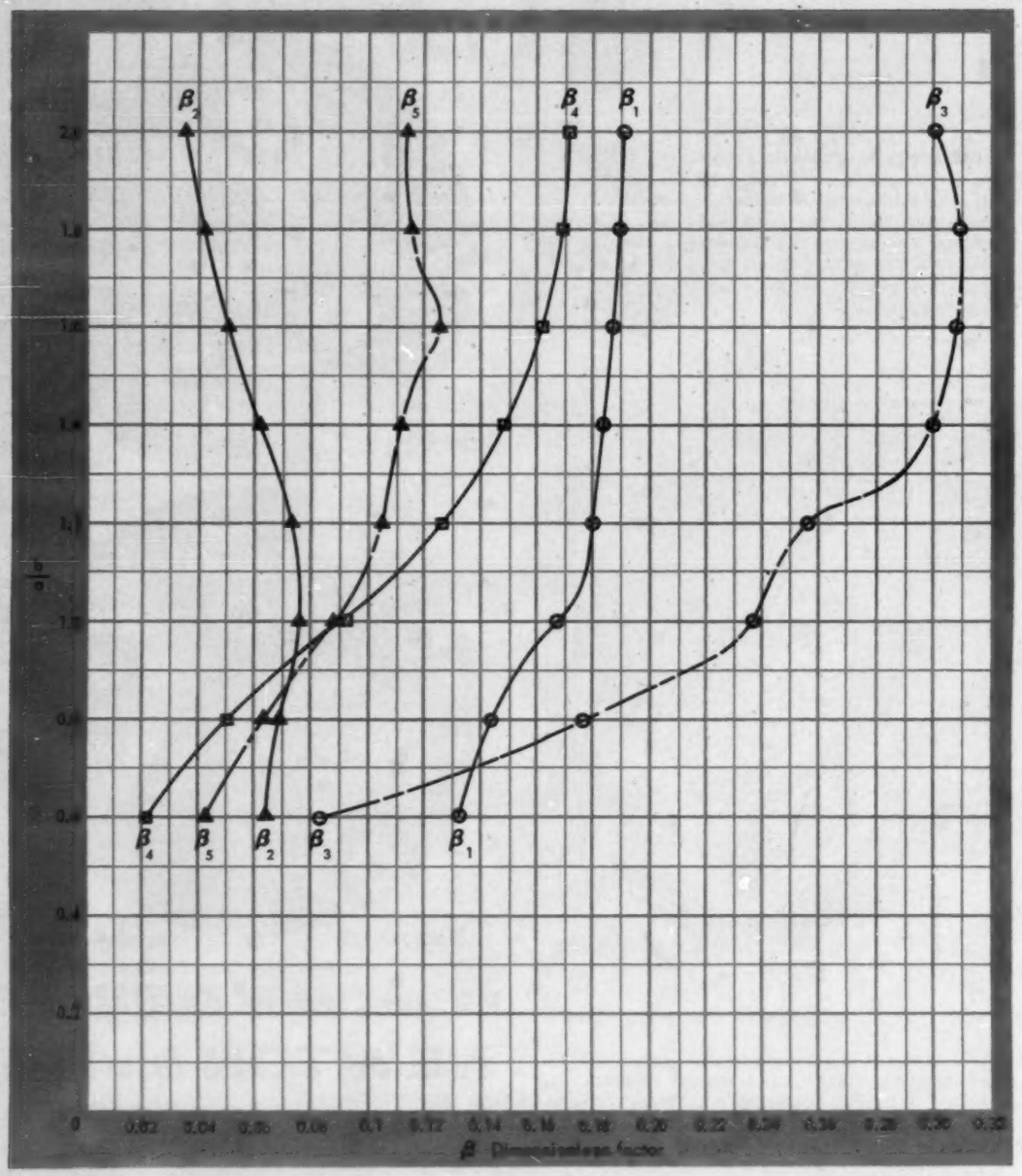
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DESIGN DATA NEWS

Fixed Plate Stress Factor

S. Warren Kaye, West Peabody, Mass.









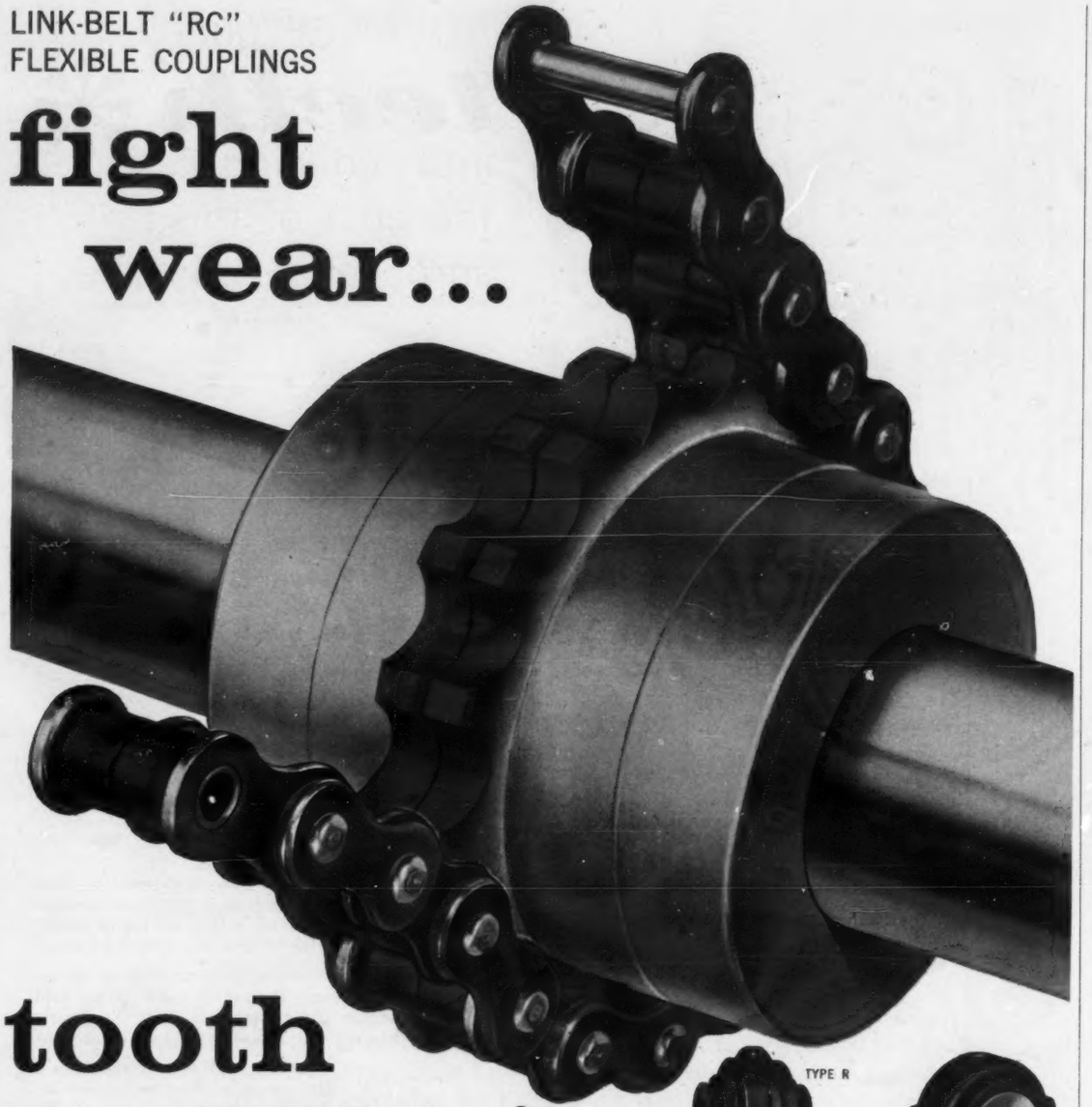


Time has brought decisive progress in the fight against cancer. Ten years ago one in four persons with cancer was saved. Today it's one in three. But time alone will not conquer cancer. Time plus research will. And research needs your dollars. Send your contribution today to "Cancer," c/o your local post office.

AMERICAN CANCER SOCIETY

LINK-BELT "RC"
FLEXIBLE COUPLINGS

fight wear... tooth and chain!







To help you get greater coupling life, Link-Belt offers two types of housings. Both are designed to facilitate lubrication, retain lubricant and protect the coupling from dust or moisture. Type R—spun metal, vertical split. Type P—molded plastic, horizontal split.

ALL WEAR SURFACES HARDENED



The high hardness of chain rollers and sprocket teeth gives Link-Belt "RC" flexible couplings the stamina to withstand shock loads, reversing loads and any pulsating load in normal service. Long life is assured on both low- and high-speed operations. This durability plus remarkable simplicity of design—easy installation—adds up to important savings of both time and money. Want to measure the savings in terms of your own application? Contact your nearest Link-Belt office listed under COUPLINGS in the classified section of your telephone directory. Ask for Folder 2363.

LINK-BELT

FLEXIBLE COUPLINGS

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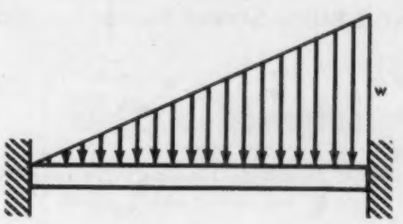
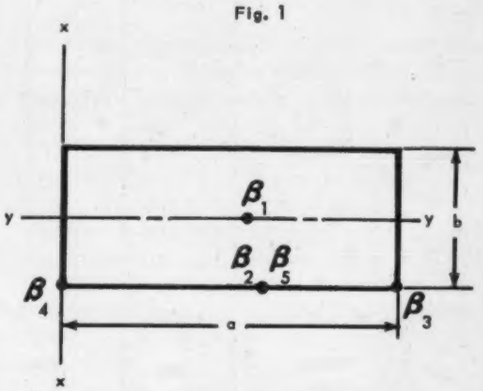


Fig. 1



In order to determine the maximum stress of a plate (all edges fixed, distributed load varying linearly along the length), it is necessary to determine the fixed plate factor β. The accompanying graphs eliminate tedious methods required to solve β and are based on the following assumptions:

1. The plate is flat, of uniform thickness and of homogenous isotropic material.
2. The thickness is not more than ¼ of the least transverse dimension.
3. All forces, loads and reactions, are normal to the plane of the plate.
4. The plate is not stressed beyond the elastic limit.

The general equation for maximum stress is:

$$S_{max} = \beta [(w)(a^2)/(t^2)]$$

To localize the stress, β is shown with subscripts 1, 2, 3, 4 and 5 (see Fig. 1).

Maximum $S_b = \beta_1 [(w)(a^2)/(t^2)]$
at $x = \pm 0.5b$, $y = 0.55a$

$S_b = \beta_2 [(w)(a^2)/(t^2)]$
at $x = 0$, $y = 0.6a$

Maximum $S_a = \beta_3 [(w)(a^2)/(t^2)]$
at $x = 0$, $y = a$

$S_a = \beta_4 [(w)(a^2)/(t^2)]$
at $x = 0$, $y = 0$

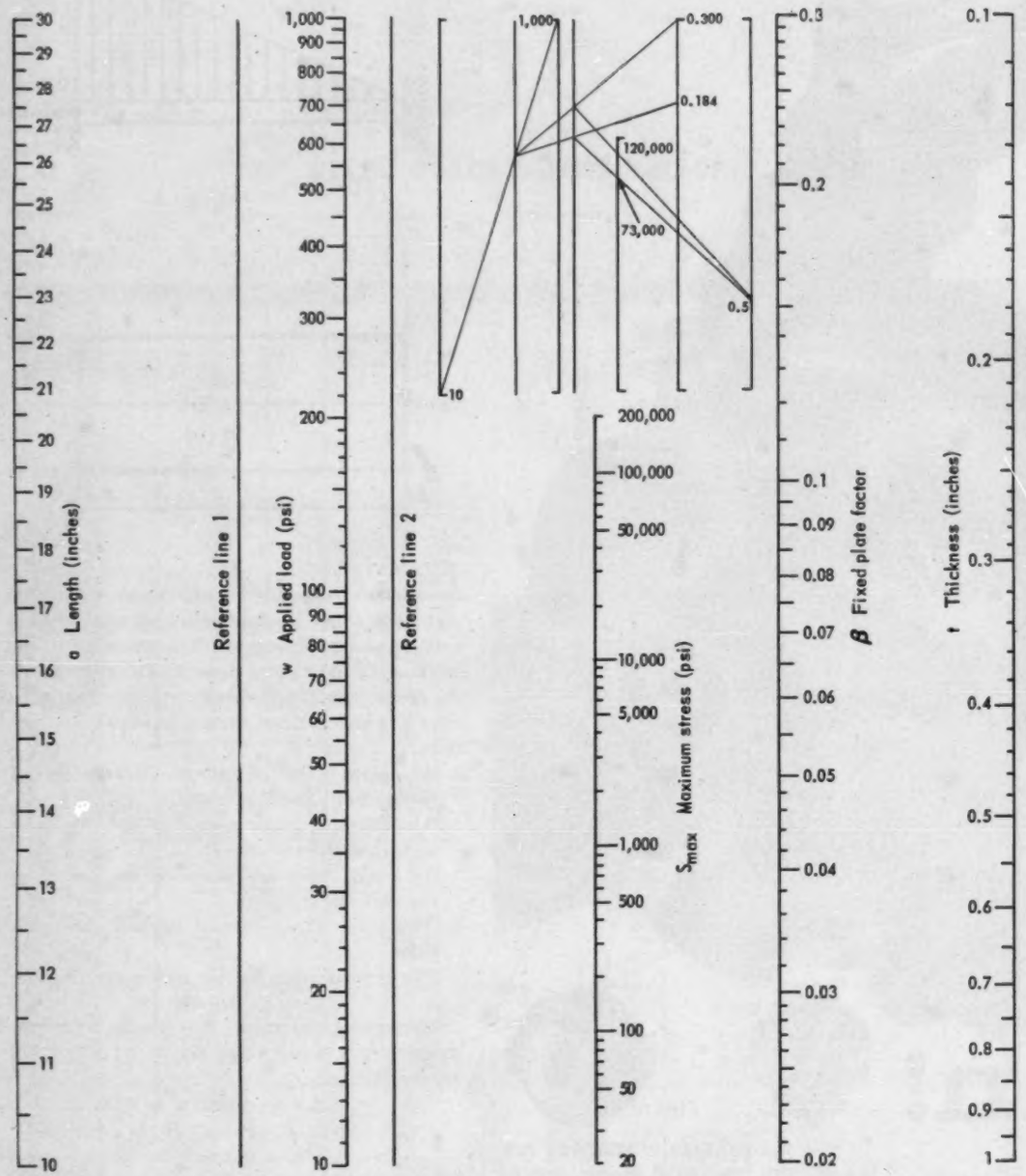
$S_a = \beta_5 [(w)(a^2)/(t^2)]$
at $x = 0$, $y = 0.6a$

Where: β with subscripts 1, 2, 3, 4 and 5 depends upon b/a and Poisson's ratio, $\mu = 0.3$ (which is applicable to both steel and aluminum), and localizes the stress.

w = applied load, psi

(Continued on next page)

Fixed Plate Stress Factor . . . Cont.



a = length, inches
b = width, inches
t = thickness, inches
S_a = stress in direction of dimension a, psi
S_b = stress in direction of dimension b, psi

Example: Determine maximum S_b and maximum S_a for ½-inch-thick plate of 4340 steel if b = 14 and a = 10 inches subjected to load of 1000 psi = w. Plate is fixed on all edges and S_{tu} = 150,000 psi.

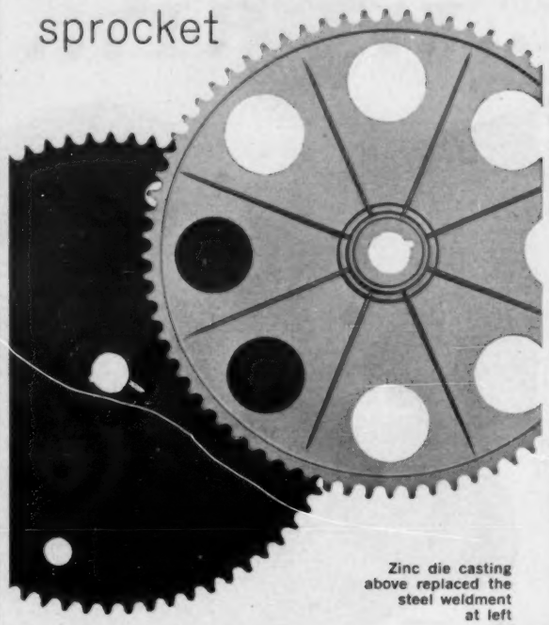
Solution: b/a = 14/10 = 1.4. Using graph, β_1 = 0.184 and β_2 = 0.300. Using nomogram to determine maximum S_t, align a = 10 with w = 1000, intersecting Reference line 1. Align this intersection with β_1 = 0.184, intersecting Reference line 2. Align this intersection with t = 0.5 and read $S_b \cong$ 73,000 psi. To determine maximum S_a, align intersection on Reference line 1 with β_2 = 0.300, intersecting Reference line 2. Align this with t = 0.5 and read $S_a \cong$ 120,000 psi.

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ADVANCE put

teeth *

into reducing the cost of this sprocket



Zinc die casting above replaced the steel weldment at left

* By "teeth" we mean Advance engineers bit deep into the cost of the 12-inch steel weldment sprocket shown above and came up with a **saving of better than 50%** in converting it to a zinc alloy die casting.

The sprocket drives the rotating drum of an industrial clothes dryer. Both pitch and O.D. are held to .010 tolerance. Interchangeable cores and inserts readily produce this sprocket with ¾ or 1 inch bore.

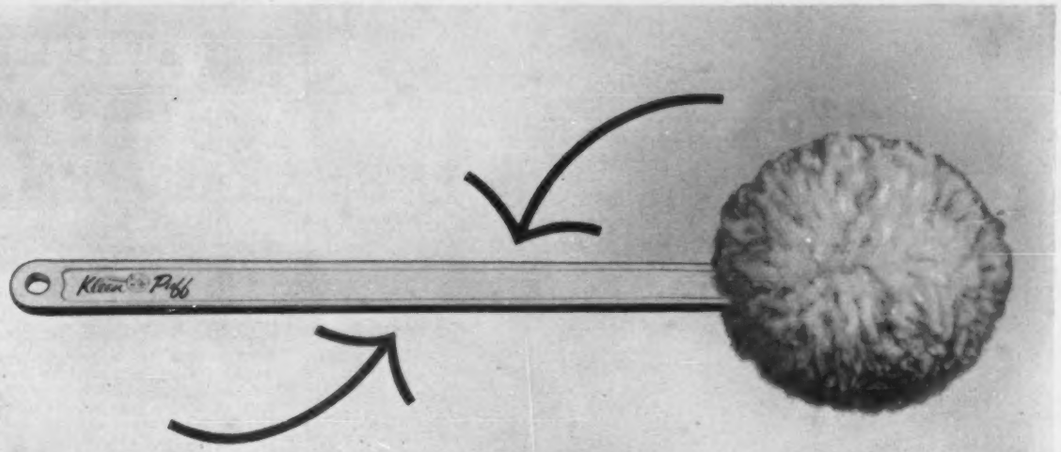
Whether it's a conversion, or a die casting of completely new design, putting "teeth" into a die casting cost problem is what Advance engineers like most to do.

Why not send your next print to Advance for a quotation? Ask for the Advance folder "Your Doorway to Certified Zinc and Aluminum Die Castings".

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CMPC-molded mop handle has built-in germ fighter

Often, engineered plastics add important extra sales features to a product. A good example is the "Kleen-Puff"® mop, manufactured and sold internationally by the Zelinkoff Company of Wichita, Kansas.

CMPC injection molds the one-piece handle using a polypropylene-bacteriostat mixture. The bacteriostat, Biozel®, inhibits the growth of bacteria and odor-causing germs and resists mildew and mold . . . a big selling plus with housewives. Biozel is non-toxic and non-irritating to the skin. Tests indicate that its effectiveness continues for a year and longer.

Polypropylene was selected for the handle because of its strength, light weight and flexibility. These properties enabled CMPC to mold a small strap, used to fasten the mop attachment, as an integral part. Thus, the handle is strong and flexible—will bend around curves without breaking and it has no sharp edges to scratch surfaces being cleaned.

Perhaps these same advantages can be applied to your product. A call to your Chicago Molded Sales Engineer will bring you the services of an experienced and trained plastics specialist. Or write:

Send for new brochure "Design and Purchase of Custom Molded Plastics."

CMPC

CHICAGO MOLDED PRODUCTS CORPORATION
1020 B North Kolmar Avenue
Chicago 51, Illinois

Please write direct to supplier, mentioning Design News

Oblique Triangles

Formulas for Finding Coordinate Dimensions When Three Sides Are Known

William W. Johnson, Cleveland, Ohio

The formulas below are particularly useful where dimensions are given in several decimal places and where final answers must provide similar accuracy.

The three sides a, b and c are shown. Find m, n and h. There are two cases. From Fig. 1:

$$b^2 - m^2 = h^2 = a^2 - n^2$$

Transposing and factoring:

$$(m + n)(m - n) = (b + a)(b - a)$$
$$(m - n) = (b + a)(b - a)/(m + n)$$

Substituting $(m + n) = c$, and letting $(m - n) = k$:

$$k = (b + a)(b - a)/c \quad (1)$$
$$m = [(m + n) + (m - n)]/2$$
$$\therefore\ m = (c + k)/2 \quad (2a)$$
$$n = [(m + n) - (m - n)]/2$$
$$\therefore\ n = (c - k)/2 \quad (3a)$$
$$h = \sqrt{b^2 - m^2}$$
$$= \sqrt{(b + m)(b - m)} \quad (4)$$

From Fig. 2, $k > c$, therefore:

$$m = (k + c)/2 \quad (2b)$$
$$n = (k - c)/2 \quad (3b)$$

For either case, find k from (1) and substitute in (2) and (3) to find m and n.

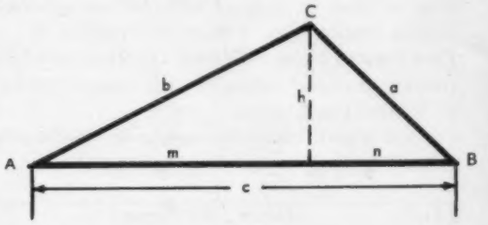


Fig. 1

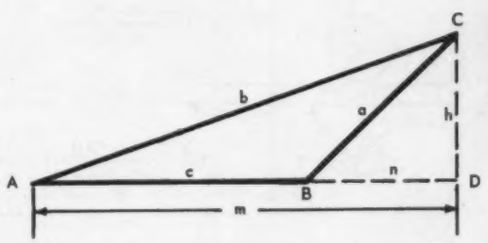


Fig. 2

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Crushing Strength Of Steel Balls

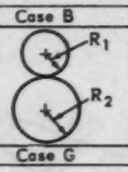
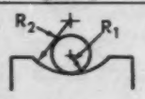
R. H. Warring, Beckenham, Kent, England.

When steel balls are used under load in cases other than in rolling bearings, an estimate of crushing strength must be taken into account. The nomogram gives minimum and maximum crushing strength values likely to be experienced over a typical range of standard steel balls. For design purposes, the average of minimum and maximum values can be taken as appropriate and a safety factor of at least 4 allowed.

Typical cases follow. They are illustrated opposite the left-hand scale of the nomogram:
Case A: Three balls of equal radii in contact, or load-carrying ball in contact with two spherical surfaces of same radii.
Case B: Ball in contact with spherical surface with radius = 2 times ball radius.
Case C: Ball in contact with one concave and one convex surface; concave and convex surface radii $\cong$ 5 times ball radius.
Case D: Ball in contact with two plane surfaces.
Case E: Ball loaded in contact with single plane surface.
Case F: Ball in contact with two concave surfaces, each of radius = 5 to 7 times ball radius.
Case G: Ball in contact with hollow spherical surface of radius = 2 times ball radius.
Case H: Ball located between two close-matching concave surfaces; radius of each concave surface $\leqq$ 1.1 times ball radius.

Cases B and G lend themselves to general solutions (Fig. 1).

Fig. 1 GENERAL SOLUTIONS

Case B	Case factor
	$= (4)\left(\frac{(R_2/R_1)}{(R_2/R_1)+1}\right)^2$
Case G	**Case factor**
	$= (4)\left(\frac{(R_2/R_1)}{(R_2/R_1)-1}\right)^2$

Example: Given Case D loading, determine average crushing strength for 0.25-inch-dia steel balls. Solution: Align Case D on case factor scale with



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TIME SAVING was the benefit when this Tinnerman Harness Clamp was used to fasten wire bundles to an aircraft structure. Inset shows safe, interlocking tongue and slot that can't spring open accidentally, yet opens readily for servicing without removing clamp from bulkhead.

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When buying clamps or spring-steel fasteners, look for the T-mark...your assurance that you're putting Tinnerman quality and total reliability into your products. For samples, literature, prices call your local Tinnerman Sales Office . . . listed in the "Yellow Pages" under "Fasteners." Or write to: *Tinnerman Products, Inc., Department 12, Box 6688, Cleveland 1, Ohio.*

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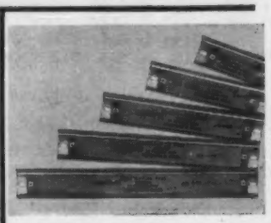
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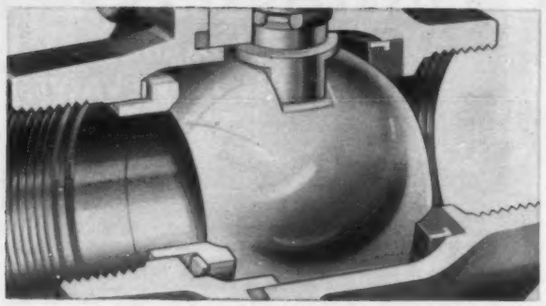
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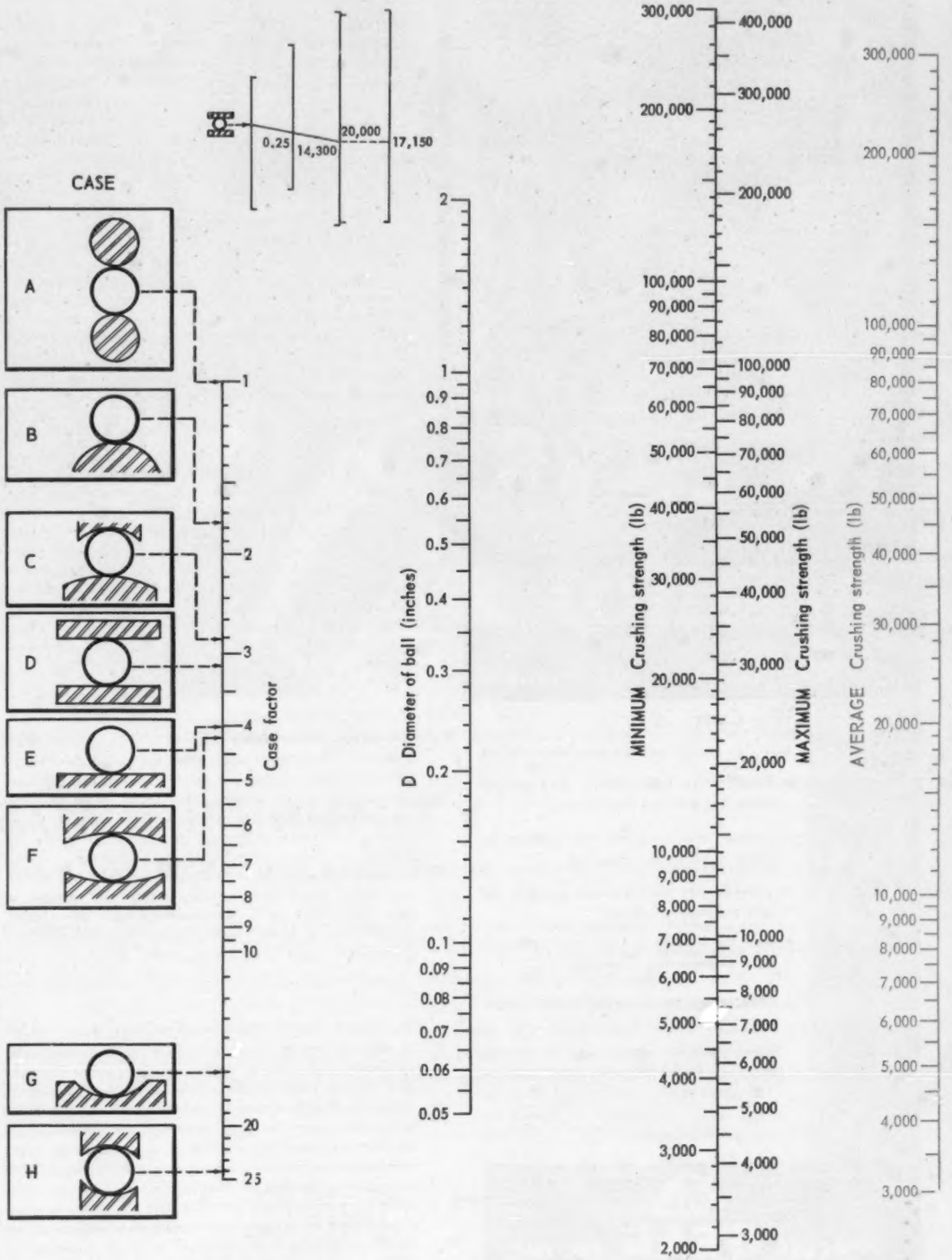
Get complete facts from Rockwood Sprinkler Company, Ball Valve Department, 852 Harlow Street, Worcester 5, Mass. Distributors in all principal industrial areas. Rockwood Sprinkler Company, A Division of The Gamewell Company, A Subsidiary of E.W. Bliss Company.

ROCKWOOD

BALL VALVES

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D = 0.25 and read minimum crushing strength = 14,300 lb and maximum crushing strength = 20,000 lb. Project horizontally to average scale and read 17,150 lb. This value can be assumed as the average crushing strength of a 0.25-inch-dia steel ball under conditions given.



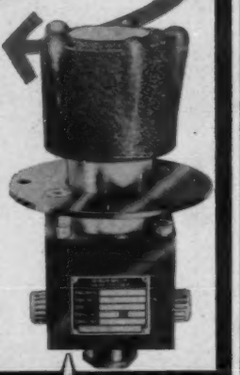
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NEW LITERATURE

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Silicon Rectifiers 451

Detailed information on the features, operational characteristics and construction of a new line of silicon d-c power supplies rated 0.75 to 75 kw. Bulletin GEA-7066, 6 pages, covers three basic types of silicon rectifiers—general-purpose, essential service and synchronous-motor field-excitation units. General Electric Co., Schenectady 5, N.Y.

Electromechanical Devices 452

Manual 361 is designed to assist the engineer in selection and application of electromagnetic clutches/brakes, mechanical clutches, torque indicators, torque standards and multispeed transmissions. Specifications, dimensional data, schematics, a performance curve method of operation and ordering code are given on 354 standard clutch/brake units. A torque-conversion chart completes the 44-page handbook. Autotronics, Inc., Florissant, Mo.

How to Train Electronics Personnel 453

Created to outline the potentials offered through home study in the electronics field, this booklet's contents are directed to industrial employers, utilities, government officials, commanders of military units and educators. The 32-page brochure discusses the growing requirements for trained people in this fast-growing field and the upgrading of those already in it. Technical courses offered by the publisher are described in detail. Cleveland Institute of Electronics, 1776 E. 17th St., Cleveland 14, Ohio.

Stainless Machining Chart 454

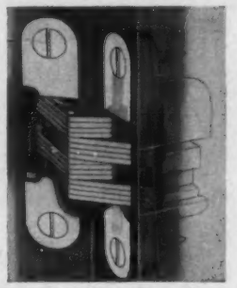
Provides a table of recommended machining rates for 37 different types of stainless steel including the PH (precipitation-hardening) grades. This chart shows 10 separate machining operations with specific tooling data condensed for quick reference. Recommended rates for turning, threading, milling, tapping and drilling are shown for each stainless grade. Turning rates are detailed for automatic, heavy-duty spindle, turret and Swiss-type lathes. An SFM to RPM conversion table is included. Peter A. Frasse & Co., Inc., 17 Grand St., New York 13, N.Y.

In-Circuit Semiconductor Testing 455

Some important requirements of in-circuit testing, with particular application to diodes, rectifiers and transistors. This 12-page guide discusses some of the requisites of in-circuit testing, including consideration of semiconductor types, their electrical and mechanical considerations, desirability of measuring operable as well as defective types and the self-sufficiency of the testing unit. Model ICT-100 in-circuit test set and its relationship to the present state-of-the-art is described. Valuable data are given to show effectiveness of in-circuit test sets which will be of interest to military and industrial users of transistorized systems and equipment. Molecular Electronics, Inc., 87 Weyman Ave., New Rochelle, N. Y.

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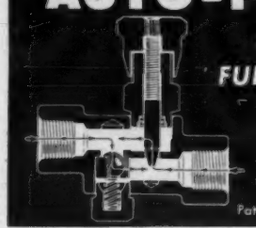
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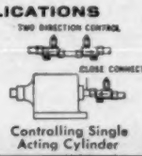


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Replacement Transformers 456

Catalog S-106, 32 pages, lists detailed electrical and physical specifications of 870 transformers for a wide range of radio and television, industrial and communication applications. It includes an output transformer chart indicating the proper output transformer to be used with a wide range of standard and high-fidelity output tubes. Numerous impedance and frequency-response curves are shown. Stancor Electronics, Inc., 3501 Addison St., Chicago 18, Ill.

Aluminum Tooling Plate 457

Form 11-11525 describes the only complete line of aluminum tooling plate designed to meet all machining specifications. Advantage of using Types 100, 200 or 300 tooling plate are given and a reference table compares tolerances, properties and other pertinent data. Type 100 is a non-heat-treated wrought grade. Type 200 is a heat-treated wrought grade and Type 300 is a cast, machined plate designed to meet the most exacting requirements of tool and jig plate through freedom from internal stress. Aluminum Co. of America, 792 Alcoa Bldg., Pittsburgh 19, Pa.

Corrosion Resistance of Zirconium 458

Contains detailed graphs for more than 100 highly corrosive media in concentrations up to 100 percent and temperatures up to 400F. Data contained in this 14-page book were compiled from information developed by leading industrial corrosion-testing laboratories. Alphabetical listing of the corrosive media provides ready reference and the booklet is a useful tool for anyone interested in improving a product or process involving corrosion resistance. Zirconium Association, 2130 Keith Bldg., Cleveland 15, Ohio.

Electronic Wire and Cable 459

Details on more than 6000 electronic wire, cable and tubing stock products and an introduction to eight new wire and tubing lines. The new products are heat-shrinkable tubing, retractile coil cords, "Teflon" tubing, zipper tubing, shielding and brading, shielded "Teflon" cables, "Teflon" magnet wire and shielded audio cable. The 52-page catalog is indexed alphabetically, numerically and by government and industrial specification. It contains an "E-Z" index chart with which any catalog item can be located by number of conductors, wire size and whether it is shielded or unshielded. Alpha Wire Corp., 200 Varick St., New York 14, N. Y.

Cabinet Racks, Console Assemblies 460

Catalog 61 contains illustrations, descriptions, specifications and prices of cabinet racks and console assemblies. The 36-page brochure gives several innovations designed to assist engineers in planning their electronic housings, including a component group check list which breaks down all basic units needed to make single, double or triple console assemblies. Pages 2 and 3 illustrate how cabinet racks and console assemblies can be combined effectively. Data on cabinet racks include photographic illustrations, cutaway views and listing of five heights, three widths, two depths, assortment of finishes, units with rear doors, and front and rear doors. Par-Metal Products Corp., 32-62 49th St., Long Island City 3, N.Y.



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LITERATURE

Gearheads, Speed Reducers 461

Section 1 of 28-page Catalog 600-1 deals with facilities from engineering to manufacturing. Section 2 is an engineer's handbook for gearheads and speed reducers. Information is provided on choosing gearheads, advantages of standard gearheads and gear ratio selection. Section 3 contains specifications, motor pinion data, standatd ratios, dimensional drawings and illustrations for Sizes 8, 10, 11, 15, 18, 21L and Type 120 gearheads. Section 4 describes servosystems and gear trains. Superior Mfg. & Instrument Corp., 36-07 20th Ave., Long Island City 5, N.Y.

Thermoelectricity 462

"The Coming Age of Thermoelectricity" points out the present state of this science. Current developments are given on the "Seejenator" compact power package that creates electricity directly from heat. A candle-flame as heat source operates a Seejenator-powered transistor radio. The four-page folder explores future applications of thermoelectricity in sun-powered irrigation, civilian defense emergency power, space station communications and aerodynamically generated heat transformed into a power source. Harco Laboratories, Inc., 77 Olive St., New Haven, Conn.

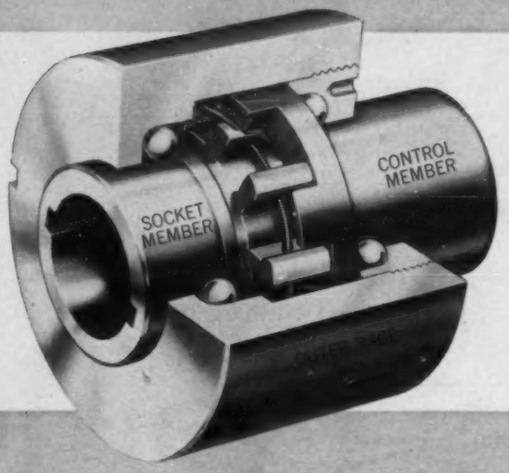
Ceramic Tubes 463

The electronic industry's most complete compilation of information on ceramic receiving tubes is contained in this two-volume publication. Bulletin ETD-2713, 213 pages, contains full technical data on a line of 20 registered and 15 developmental ceramic tube types. Also presented are diagrams, graphs, illustrations, a tube selection chart and typical socket data. Bulletin ETD-2134, 52 pages, contains application information as well as data on design, materials, manufacturing, UHF-VHF performance and reliability of small ceramic receiving tubes. General Electric Co., Receiving Tube Dept., Owensboro, Ky.

Elastomer-Fabric Diaphragms 464

Long-stroke, rolling, preconvoluted and molded convolution diaphragms for either static or dynamic applications. Form D1-100 contains a wide range of elastomers used in diaphragms ranging from neoprene, nitrile and butyl to silicone, fluorinated silicone, "Viton" and polyurethane. Fabrics, such as "Teflon", "Dacron", glass and cotton are reviewed to assist the design engineer in the selection of diaphragms to meet specific environmental and operating characteristics. A comprehensive design worksheet is included to facilitate inquiries pertaining to diaphragms and/or complete actuator assemblies. Diaphragm Industries, Inc., 102 Rantoul St., Beverly, Mass.

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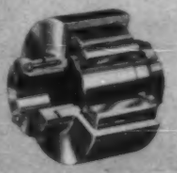
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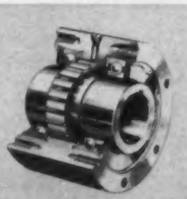
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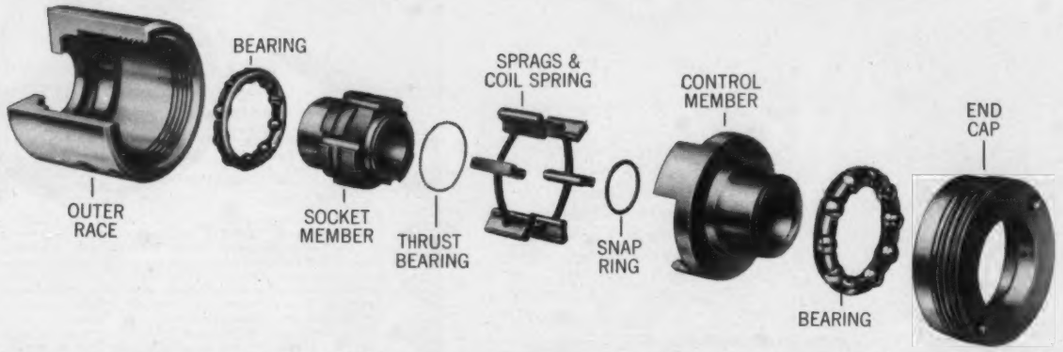
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(Figure 4) When the SOCKET MEMBER is held stationary and the CONTROL MEMBER is held in a neutral position between the sprags, any input torque applied to the OUTER RACE is instantly stopped by the wedging of the sprags between OUTER RACE and fixed SOCKET MEMBER. However, by applying a relative torque to the CONTROL MEMBER in one direction (Figure 5), the OUTER RACE can over-run in the opposite direction and will also be backstopped. To reverse the direction of OUTER RACE over-running and backstopping, the torque applied to the CONTROL MEMBER is reversed.

(Figure 6) If the CONTROL MEMBER is held in a fixed position and the SOCKET MEMBER is allowed to float freely on a shaft, the OUTER RACE will over-run in either direction. However, if a torque is applied to the SOCKET MEMBER, the OUTER RACE will only over-run in the direction that the torque is applied and will backstop in the opposite direction.

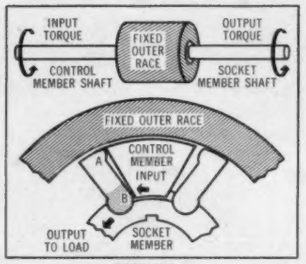


FIGURE 1

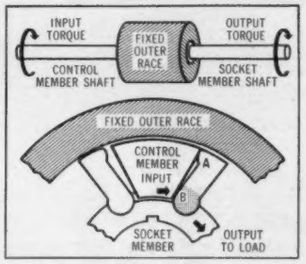


FIGURE 2

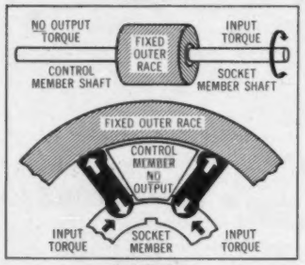


FIGURE 3

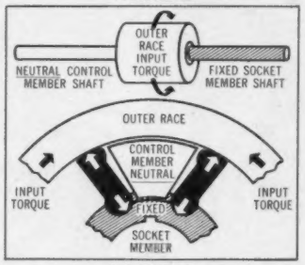


FIGURE 4

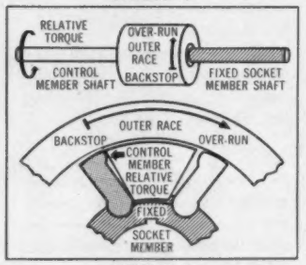


FIGURE 5

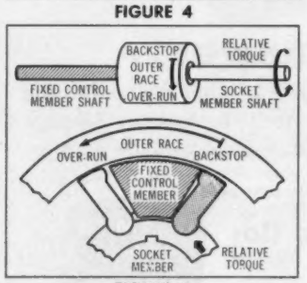


FIGURE 6

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Electron Tubes 465

Condensed data on a line of tubes. Quick-reference guides help the reader determine which electron tube he requires and business reply cards provide a means for requesting complete tube data, auxiliary information or engineering assistance. New product lines shown in this 32-page brochure are vapor-cooled triodes, additions to the hard-pulse tube modulator group and UHF planar group. Machlett Laboratories, Inc., Springdale, Conn.

Tubing Buyers' Guide 466

Principal characteristics, size range and relative cost of carbon and alloy steel tubing for mechanical, structural and hydraulic applications. Stainless steel, aluminum and industrial plastic tubing are covered in this revised technical bulletin 12-10, four pages. Tips on when to use tubing instead of bar stock for parts production and how to buy tubing economically round out the data. Joseph T. Ryerson & Son, Inc., Box 8000-A, Chicago 80, Ill.

Power Supplies 467

Complete data on more than 150 standard models of regulated d-c power supplies, including semiconductor, vacuum-tube, magnetic and hybrid designs. Catalog B-611, 32 pages, includes three new power supply lines, "SM", "HB" and "PR". There is a separate listing and description of programmable current/voltage-regulated models and a nomograph of voltage drop versus wire size and supply current. All models are indexed by design group and by output voltage. Kepco, Inc., 131-38 Sanford Ave., Flushing 52, N.Y.

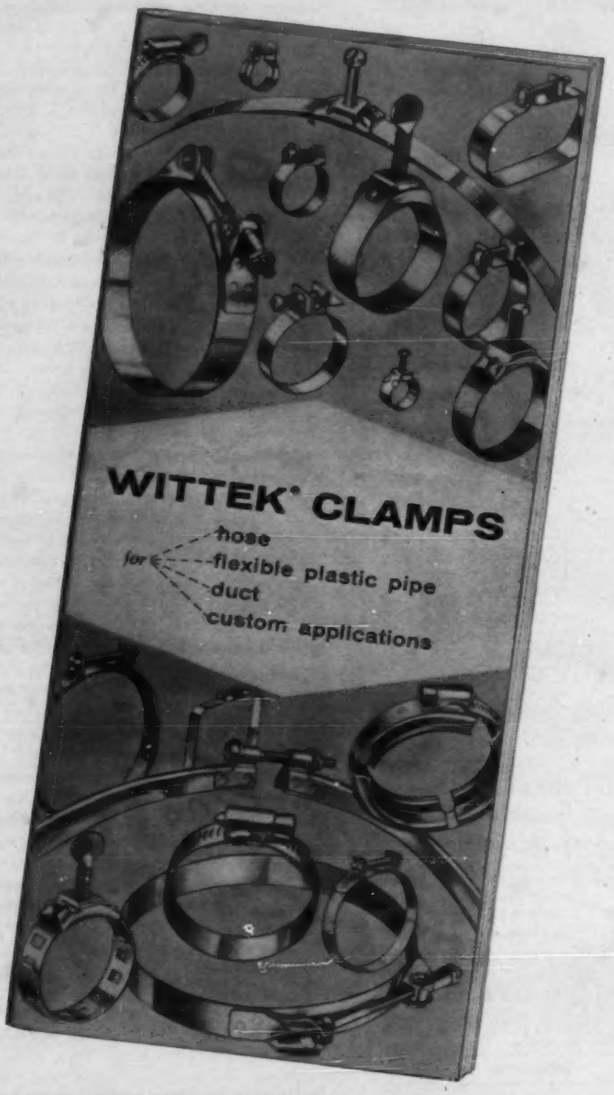
Bearings 468

Self-aligning bearings and rod-end bearings are detailed in Catalog No. 551, 56 pages. The entire line of "Monoball" bearings is covered and new "Dyflon" plastic alloy insert, self-lubricated bearings are included. These bearings are available in a variety of plain or rod end types. Bore sizes are offered up to 6.000 inches and ultimate static loads to 4,500,000 lb. Materials include stainless steel, plastic alloys and chrome alloy steels. Southwest Products Co., 1705 S. Mountain Ave., Monrovia, Calif.

Indicator Lights 469

Bulletin No. 107 features FML series front-mounting indicator lights with "slip-in" installation feature. Diagrams show a full-sized outline drawing of the series with mounting hole dimensions and electrical connections. The lights are available in two terminal types with two slip-in lens styles, nine lens colors and optical hot stamped legends. Complete physical and electrical specifications are included in the two-page data sheet. Transistor Electronics Corp., 3357 Republic Ave., Minneapolis 26, Minn.

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LITERATURE

Transistor Guide

Presents a comprehensive summary of the basic ground rules to be followed in designing transistorized communication circuits. Practical information, circuit diagrams, curves and equations are given to aid in the design of transistor circuitry for audio, video, RF and IF amplifiers, mixers and converters, oscillators, multipliers and high-frequency—high-power output stages. Basic aspects of circuit configurations, variation of noise figure with frequency, biasing and d-c stability are examined separately. A chart is included listing specific transistors which have been designed and specified for each of the communications sockets. The guide is available by writing to: Philco Corp., Church Rd., Lansdale, Pa.

Industrial Glassware

Bulletin B-91 gives the properties and advantages of "Vycor" brand glasses. Applications for the 96 percent silica glasses are listed and latest data are provided on the 10 glasses from which Vycor brand products are made. Available by writing: Corning Glass Works, Corning, N.Y.

Electronic Equipment

More than 115 manufacturers and their products in the industrial electronic field are listed in this 1961-62 catalog. Complete price and performance information is given for a wide range of industrial electronic equipment and components and for amateur radio and public address systems equipment. The 292-page catalog is indexed by manufacturer and product. A special feature is a listing by manufacturer of those product lines which are available on an industrial quantity price basis. An industrial tube cross-reference is provided. Available on written request to: Electronic Publishing Co., 180 North Wacker Dr., Chicago, Ill.

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Laminated Plastics

Industrial laminated plastics in sheet, rod and tube form are described in Catalog D-61. The 20-page brochure covers grade selection and description, range of sizes, typical property values and forms. A special section details metal-clad grades. Available on written request to: Continental-Diamond Fibre Corp., Newark, Del.

Instrument Motors

Construction and operation of different types and models of instrument motors. Bulletin IM-1, 28 pages, includes dimensional drawings, rating charts, wiring diagrams, listings and photographs of the motors. Special sections discuss the availability of engineering service, development and testing procedures, typical applications and applications guidance. Bodine Electric Co., 2500 W. Bradley Pl., Chicago 18, Ill.

RF Amplifier Guide

A graphic aid for quickly determining the performance of RF doublers and triplers, as well as straight-through amplifier electron tubes. "Computa-Guide" eliminates much of the mathematics involved in calculating harmonic components of a complex wave form. It should be of value to designers of transmitter, telemetry and mobile equipment, as well as ultrasonic, dielectric and induction heating equipment. The guide is printed on durable laminated plastic. All formulas needed to derive final tube performance are printed on the guide. An instruction booklet is furnished with the aid. Available by writing: Amperex Electronic Corp., 230 Duffy Ave., Hicksville, L. I., N. Y.

Research and Development

The impact of scientific and technological progress on society is being examined in more than 200 research projects. These studies are described in a new publication, "Current Projects on the Economic and Social Implications of Scientific Research and Development, 1960". Effects of scientific and technological progress are examined in relation to agriculture, impacts on selected industries, administration and management, and labor. Each project is summarized and listed with the name of the investigator, address of institution and anticipated form of publication of results. Copies may be obtained by enclosing $0.40 with written request to: Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

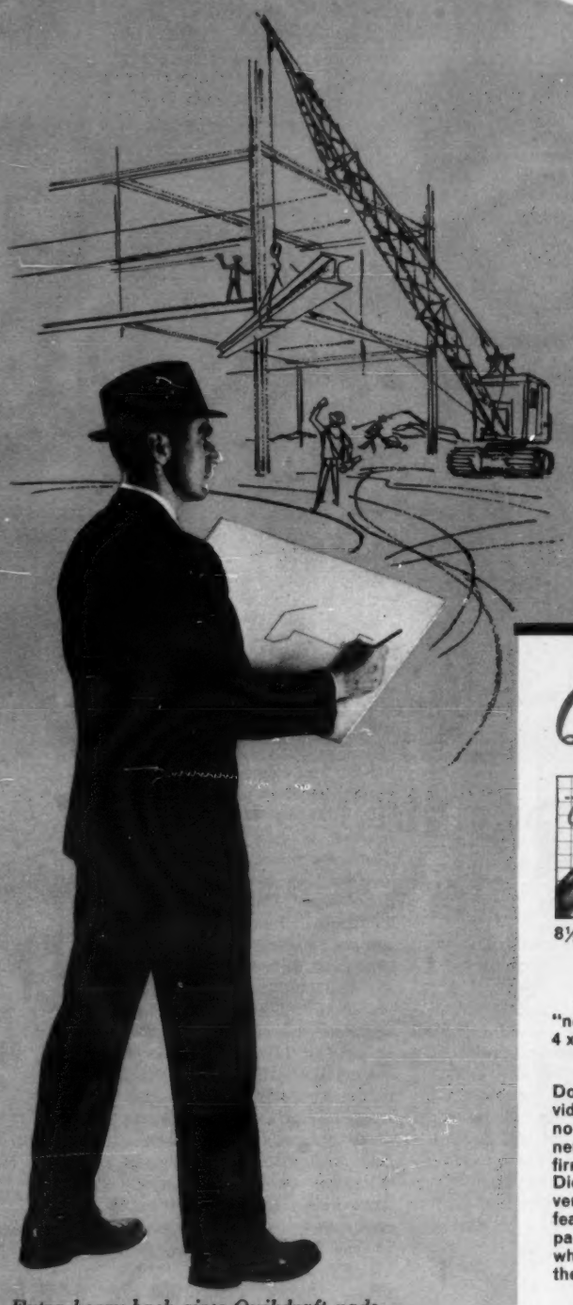
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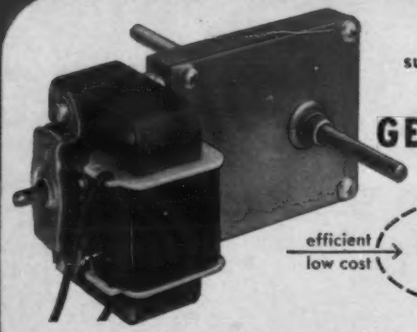
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Graphic Journalism...



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LITERATURE

ATLAS OF THE FAR SIDE OF THE MOON. A lunar atlas, compiled from the first photographs ever taken of the far side of the moon, along with detailed descriptions of its newly revealed portion as interpreted by Soviet scientists is now available. Compiled and published by the USSR Academy of Sciences, this Russian "moon atlas" is available in English through the cooperative effort of the Office of Technical Services and the U. S. Air Force. Containing 30 of the photographs transmitted to USSR observatories by the Soviet rocket, which orbited the moon in October 1959, the translation also gives a detailed description of how the pictures were taken. The Russian moon atlas contains four maps of the moon's far side prepared by Soviet astronomers and a 110-page "Catalog of the Formations of the Far Side of the Moon". This catalog contains data matching each frame exposed by the orbiting camera equipment with identifiable features of the moon's landscape. Published 1960, 195 pages, Catalog 61-21955, $3.

the proper operation of such devices depends upon precise and timely control of moving fluids. Chapter 1, 16 pages, Catalog PB 171671-1, $0.25; Chapter 7, 6 pages, Catalog PB 171671-2, $0.25.

FLUID AMPLIFIER HANDBOOK. Two chapters of this 20-chapter handbook are now available. Additional chapters will be released as data are available. Containing current information on fluid computation and control systems involving compressible fluids, incompressible fluids and combinations of the two, the handbook's contents are designed for inclusion in a loose-leaf binder to facilitate corrections, additions and rearranging of chapters as warranted. The introductory material points out that fluids in motion are used currently to perform a wide variety of tasks in military and industrial applications. For example, the proper operations of such devices depends upon precise and timely control of moving fluids. Chapter 1, 16 pages, Catalog PB 171 671-1, $0.25; Chapter 7, 6 pages, Catalog PB 171671-2, $0.25.



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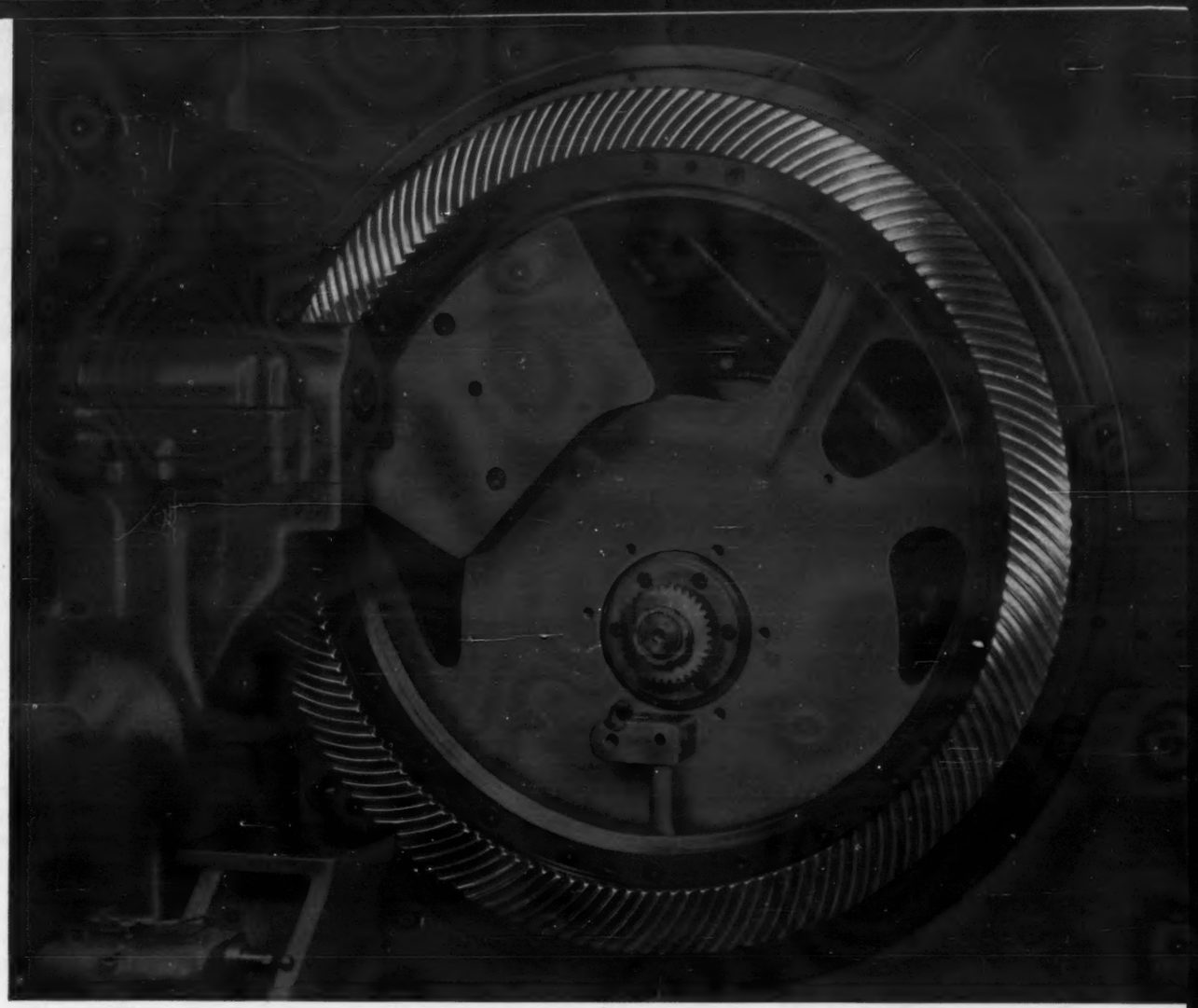
Literature available, at price listed, by writing Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., enclosing remittance.

EFFECTS OF VARIOUS EXHAUST BLAST DEFLECTORS ON THE ACOUSTIC NOISE CHARACTERISTICS OF 1000-POUND-THRUST ROCKETS. The problem of diminishing the noise made by a rocket at the moment of its launching is examined in this report. Results of an intensive study designed to solve the special problems created by the acoustic energy produced by rocket engine operations are included. These problems are fatigue and failure of structural materials, malfunction of electronic and mechanical assemblies and exposure of personnel aboard the vehicle or in adjacent launching areas and surrounding communities. Published 1960, 65 pages, Catalog PB 171 308, $1.75.

RESEARCH INVESTIGATION TO DETERMINE THE OPTIMUM CONDITIONS FOR GROWING SINGLE CRYSTALS OF SELECTED BORIDES, SILICIDES AND CARBIDES. Description of an experiment to produce selected crystals in the refractory hard metals class for mechanical and other property determinations. The project objective was to produce single crystals of selected borides, silicides and carbides of tungsten, molybdenum and titanium, sized suitably for mechanical and other property determinations. Experiments proved that best results were secured from compounds prepared by fusing together commercially available pure elements and crushing the lumps into a suitable particle-sized fraction. Published 1960, 24 pages, Catalog PB 161 792, $1.

RESEARCH ON THE FEASIBILITY OF THE LINDBERG GYROSCOPE PRINCIPLE. Evaluation of a two-rotor gyroscope as a precision direction-sensing device in missile guidance and space navigation. The study was limited to research on two fundamental components of the proposed system: the direction-sensing device, consisting of a two-rotor system using a spherical gas bearing support, and the error signal generator, for which an optical type was selected after study of capacitive and inductive types. Models of each device were constructed and laboratory tests were conducted to determine their operational characteristics under conditions simulating those of the proposed gyroscope. A comparative study was made to show the effect of rotor configuration on gyro performance. Published 1960, 122 pages, Catalog PB 171 157, $2.75.

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This thirty-one-inch gear and its pinion have a 150 to 5 ratio. Yet they are hypoids — what we call HRH or high reduction hypoids.

These compact, flexible sets can be built to ratios as high as 360 to 1 without losing the traditional advantages of Gleason design proportions.

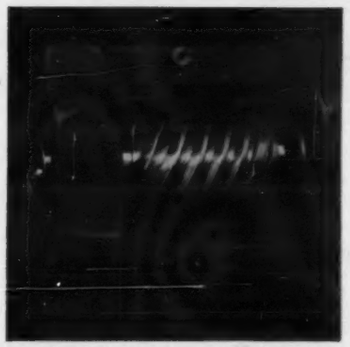
They permit you to design to tight space limits, particularly on big jobs.

They have a typically fine Gleason surface finish, impossible to get with hobbing or other methods. The pinion teeth *wrap around* the pinion, so you get continuous tooth action even with a one-tooth pinion. The resulting motion is always smooth and continuous.

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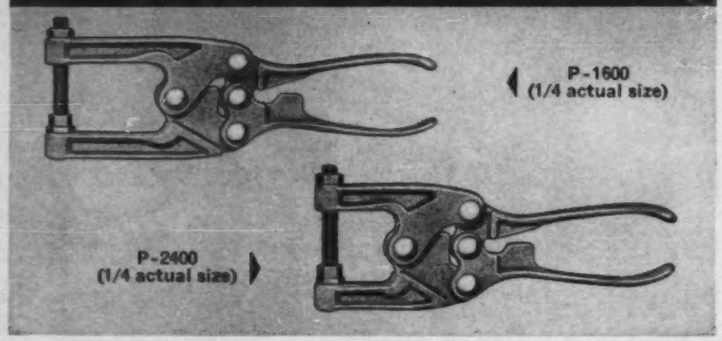
The cylindrical shape of the pinion lends itself readily to straddle mountings. The high offset design also increases the diameter of the pinion, lending extra strength to the entire assembly.

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Usable Design Ideas

TECHNICAL PAPERS

Ceramic Materials: A Chemical And Structural Description

M. G. Britton, Corning Glass Works, Corning, N. Y.

There are basically two types of structures of ceramic materials, glassy and crystalline. Glasses have no analogy in the world of the metallurgist, but the crystalline structure is familiar to the metallurgist. However, by combinations of these glassy and crystalline structures, a great variety of useful properties can be achieved (Table 1).

If a further structural aspect is added to our single crystal-glass system, a vast variety of additional ceramics is generated. This commodity is simply air, or void space. It is as important a factor in the physics and chemistry of ceramic materials as the solid part. It is the difference, for example, between a fire brick or an insulating brick, between a high-temperature semiconductor and a grinding wheel, and so on.

The final element in the structure of a ceramic is the crystal or grain size of the crystalline materials present. Fine grain size enhances mechanical strength significantly, while coarse particles are sought for some products.

Thus, the properties of a ceramic material can be defined by these factors: (1) the chemical composition of the several phases present; (2) the proportions and texture of the several phases present, and (3) the amount and distribution of void space. In discussing new materials and their applications to new situations, none of these factors can be overlooked.

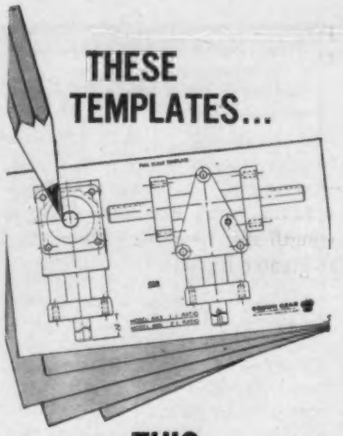
The Chemical Families

There are clearly recognizable characteristics common to these families: (1) single oxides; (2) mixed oxides; (3) carbides, borides and nitrides; (4) intermetallics and sulfides, and (5) rare earth compounds.

Oxides

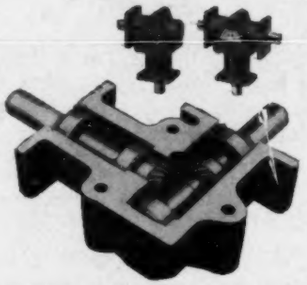
The strength of some oxides (notably aluminum oxide) increases above 500C, so that they have an increasing tendency to deform plastically rather than fracture. The elastic modules also decreases linearly with temperature until a certain point, then decreases precipitously. While single crystals may be ductile, polycrystalline oxides are not.

Elastic properties are highly structure sensitive. The low impact strength of the oxides limits their use, even at the higher temperature where



THESE TEMPLATES...

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wrap up your right-angle design problem!

. . . And the transition to the "Package" concept of right-angle power transfer is that simple with this easy-reference template kit. 18 basic Crown right-angle units are shown on six template sheets, each full scale.

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A Division of Harrington & Richardson, Inc.

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plastic deformation is possible because yield stress exceeds brittle-fracture stress.

In the oxide family only one member, silicon dioxide, of the commonly used materials can exist as a glass. The balance are crystalline, and are usually used in the polycrystalline form. The mechanical strength of such crystalline aggregates is less than the single crystal, but in most cases the strength difference is inconsequential because of the greater fracture stress at tip of a crack.

Mixed Oxides

The silicate, titanate, aluminate and spinel families offer endless variety since not only the chemistry, but also the structural variations are great in number. In fact, common usage classifies the materials of this family more from the structural standpoint than from the chemical standpoint. These classes are (1) the glasses, which are produced by fusion, forming and cooling of mixed oxides; (2) the ceramics which are produced by the forming and partial fusion or sintering of the mixed oxides, and (3) the glass-ceramics, which are a wedding of the traditional technologies in that the mixed oxides are melted and formed as are glasses, and then heat-treated to produce a composite of glass-bonded crystals.

Carbides, Borides and Nitrides

These are interstitial compounds, so called because atoms of carbon, boron or nitrogen pack themselves systematically among the atoms of a metal crystal. While much harder and having much higher thermal conductivity than the oxides, the interstitial compounds are still brittle and poorly resistant to thermal shock. The elastic moduli of the carbides are higher than those of the nitrides and borides.

Intermetallic Compounds

There are combinations of metals which have narrow composition ranges, such that they can be considered more properly to be compounds than alloys or solid solutions. The usual families are the aluminides, beryllides, germanides, silicides and so on. These compounds offer unique combinations of strength, hardness and ductility at elevated temperature, and will be researched extensively in the future.

Sulfides

These materials have high melting points but decompose readily; virtually no measurements are available on mechanical behavior.

Rare-Earth Compounds

This family of materials is completely untapped in respect to mechanical properties.

Mechanical Properties of Ceramics

Every design prediction based on published ceramic properties must be questioned until thoroughly proof-tested because test methods,

(Continued on next page)

Gasket engineering

GASKET SEALS vs. FLANGE FINISH

Smooth flanges usually help simplify gasket problems . . . but they raise machining costs. Can a gasket material compensate so well for flange roughness that machining costs can be reduced?

E. M. SMOLEY
Research Physicist
Armstrong Research and Development Center

How smooth do flange surfaces in gasketed assemblies have to be? Is there a gasket that will seal so efficiently that less machining of flange surfaces might be practical?

To answer these questions, extensive tests were conducted at the Armstrong Research and Development Center, using rough (3000 micro-inch) and smooth (5 micro-inch) flange finishes.

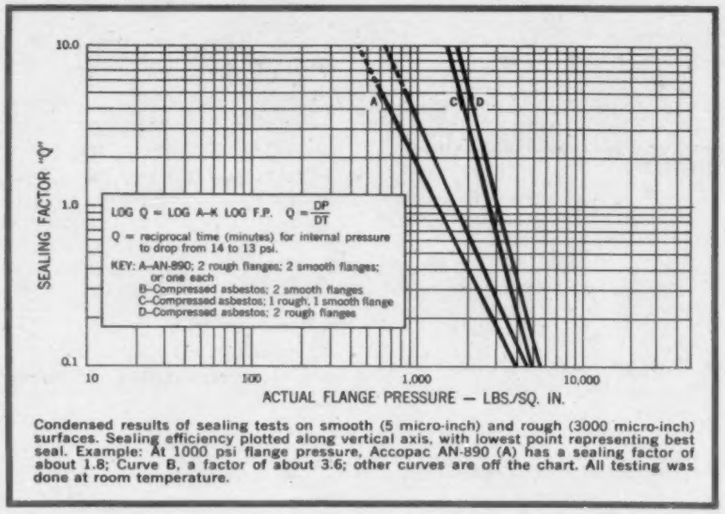
Two different gasket materials were compared: one, a standard grade of compressed asbestos; the other, Armstrong Accopac AN-890, a beater-saturated rubber-asbestos material. Both were 1/32" gauge.

In each test, air was locked in gasketed flange assemblies at an internal pressure of 14 psi. Then pressure loss was measured and recorded as a function of time by the electro-mechanical air leakage tester developed by Armstrong engineers.

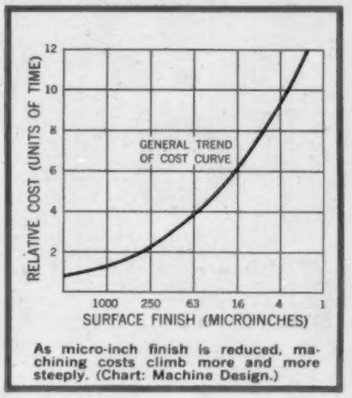
Many individual tests were run, using two smooth flanges, two rough flanges, or one of each. The results are condensed on the chart below.

The curves show that AN-890 Accopac has far better sealability with either rough or smooth flanges—or one of each—than the compressed asbestos material. Even at the relatively low flange pressure of 1000 psi, the unusual sealing ability of AN-890 is evident.

The superior performance of AN-890 is a result of the way it's made. The patented beater-saturation process gives a more uniform dispersion of rubber on fiber—hence, AN-890 is a more compressible material. As a result, it has unusual conformability to flange irregularities.



Condensed results of sealing tests on smooth (5 micro-inch) and rough (3000 micro-inch) surfaces. Sealing efficiency plotted along vertical axis, with lowest point representing best seal. Example: At 1000 psi flange pressure, Accopac AN-890 (A) has a sealing factor of about 1.8; Curve B, a factor of about 3.6; other curves are off the chart. All testing was done at room temperature.



As micro-inch finish is reduced, machining costs climb more and more steeply. (Chart: Machine Design.)

These tests indicate that Accopac AN-890 offers definite promise of efficient seals at higher micro-inch flange finishes. Its use can make possible savings in machining costs that are well worth considering.

Research on gasket performance is a continuing project at the Armstrong Research and Development Center. Our large library of data may already contain the answers to your specific sealing problems. We will be glad to make suggestions if you will send details to us. Address Armstrong Cork Company, 7106 Ithaca Street, Lancaster, Pennsylvania.

Armstrong GASKET MATERIALS

PRODUCT-DESIGN BRIEFS FROM DUREZ

How idea-men are using Hetron® in

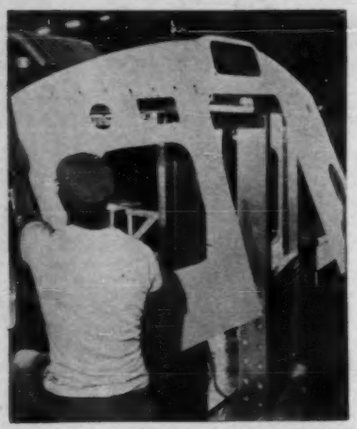
- **subway cars**
- **electrical laminates**
- **shapes with baked finishes**

Light—and tough

Philadelphia expects to save $6.5 million over the 35-year life span of its 270 new subway cars.

Built of stainless steel and with one-piece end sections of glass-reinforced Hetron polyester, the new cars save on power because they weigh about three tons less than conventional cars.

They won't ever need painting. End sections are dent-proof and virtually shatterproof. The Hetron material retards fire, and corrosion isn't expected to be a problem.



THE BUDD COMPANY

Ends of the cars were made by hand layup at Modular Molding Corp., which delivered the first unit just one month from start of tooling. Section thickness and rigidity were controlled by adding extra plies of fibrous glass where needed during layup. Gray metallic color was molded in.

Hetron is tough enough for just about any structural assignment you want to give it. Its inherent fire safety—without loss of other physicals—qualifies it for many jobs other polyesters can't do. It's used in DEW-Line radomes, U.S. Navy craft, Coast Guard-approved lifeboats.

For arcs and sparks

These dielectric laminates come in flat sheets or formed to many shapes. They are strong enough to play a structural role in heavy-duty electrical equipment.

The ones you see here are made with Hetron polyester resin by Fiber Glass Industries, Inc., and are inherently



flame retardant. Hetron burns only in actual contact with an arc or hot flame, and quickly extinguishes itself when the heat source is removed. Thus in case of a burnout, damage is usually confined to a small area, with minimum effect on mechanical strength of the material.

Generally, Hetron-and-glass laminates exhibit very low loss factor over a wide range of frequencies. Dielectric constant, for a ⅛-inch glass-mat laminate containing 35% glass, hovers as low as 4.25. Arc resistance of such a laminate is on the order of 110 seconds.

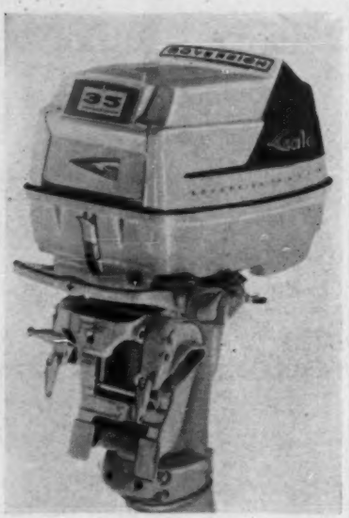
Do these traits suggest a way to achieve long life in equipment handling medium and high voltages? We'll be glad to discuss it further with you.

No craze

"Craze" is a nasty word in those circles where reinforced plastic parts are finished by painting.

Sometimes tiny surface cracks show up on otherwise perfect parts as they emerge from the drying oven. Often, the fault is in the base material, not the finish. Some reinforced plastics just aren't meant to take a 90-minute bake at 350° F.

This problem is being solved neatly by a good many knowledgeable people who specify *Hetron 32A* polyester resin for molded parts that must be painted and then baked.



Such a part is this outboard-motor shroud, produced in matched metal dies. Reinforced polyester makes a good shroud, because it muffles the motor noise rather than vibrating in resonance with it. Notice the smoothness of the baked-on alkyd finish? That's Hetron 32A under there. No craze.



Idea-file gives full information on Hetron resins. Covers uses, advantages, properties, methods of fabrication. Includes names of leading custom fabricators making panels and molded articles. To get a copy, just clip this coupon and mail to us with your name, title, company address.

DUREZ PLASTICS DIVISION

2106 WALCK ROAD, NORTH TONAWANDA, N. Y.

HOOKER CHEMICAL CORPORATION

HOOKER CHEMICALS PLASTICS

Circle 115 on Reader-Service Card for more information

Ceramic Materials . . . Cont.

TABLE I

PROPERTIES OF VARIOUS CERAMICS

Ceramic	Characteristic Structure	Characteristic Property
Soda-lime Glass	Completely glassy	Transparency
Bone China	Glass and crystalline silicates	Translucency, strength
Electrical Porcelain	Glass and crystalline silicates	Dielectric strength
Glass-Ceramics	Glass and crystalline silicates	Strength, low thermal expansion
Alumina	Completely crystalline	High strength

specimens and design concepts are subject to unpredictable variations which force us to use a statistical approach. Tensile-test methods are notoriously unsatisfactory, so that two-point loading of a beam is preferred. Fracture-mechanism research now is receiving attention in excellent work and should lead to more reliable test methods and more reliable materials.

Elastic Properties—Elastic modulus is very sensitive to specimen porosity as is the rigidity modulus. Both moduli decrease with temperature. Poisson's ratio usually is calculated from experimental values of the elastic and rigidity moduli.

Compressive Strength—In very dense bodies, slight porosity increases (of the order of a few percent) reduce strength drastically.

Tensile Strength—The difficulty of this test is indicated by the experimental problem: a displacement of 1 percent in the loading axis from the geometric axis results in a 6-percent change in strain in each surface of the specimen.

(Continued on page 113)

Circle 116 on Reader-Service Card

One-inch body diameter
valve line



Completely new series of **SKINNER** solenoid valves facilitates further miniaturization

Here's a really miniature stainless steel solenoid valve with all the features of a larger valve

think small



VALVE SHOWN ACTUAL SIZE

- Now designers of pneumatic and hydraulic control systems and devices requiring high flow in smaller packages can **specify miniature solenoid valves from shelf stock.**
- These new B Series valves are so small and so new that ⅛" NPT was too large, therefore 1/16" PTF connections were selected. Fittings are included to make fluid connections with ⅛" tubing.
- Never before have there been valves like this—**really miniature in over-all size, pipe size, and weight.**

VITAL STATISTICS

Type	3-way normally closed
Over-all size	1" x 2 1/16"
Orifice size	3/64" Inlet and Outlet
C_v factor	.045
Fluid connections	1/16" PTF (adapted for ⅛" tubing)
Weight	5 oz.
Maximum operating pressure	150 PSI
Vacuum	Down to 5 microns

Skinner Distributors are now stocking the first of these new valves—the three-way normally closed. Three-way normally open and directional control, two-way normally open and normally closed, and higher pressure models will be on the market soon.

For complete information contact a Skinner Distributor listed in the Yellow Pages or write us at the address below.

B SERIES FEATURES

No leakage—Soft, synthetic inserts provide bubbletight sealing. Seats have smooth rounded edges—no cutting of insert material.

Mounting by means of two tapped mounting holes (8-32) in valve body. Can be mounted in any position.

Voltage—Coils available in most AC and DC voltages. Heat rise meets U.L. standard of 85°C maximum for continuous duty. Maximum power requirement—7 watts.

Electrical housings are available with single grommet or ¼" NPT conduit which can be rotated 360°.

Media—B Series valves may be used with all common media including many semi-corrosive fluids.

Corrosion-resistant—Stainless steel body and internal parts.

SKINNER ELECTRIC VALVES®

THE CREST OF QUALITY

SKINNER ELECTRIC VALVES

SKINNER ELECTRIC VALVE DIVISION
SKINNER PRECISION INDUSTRIES, INC. • NEW BRITAIN, CONNECTICUT, U.S.A.

PRINTED IN U.S.A.

Bend Strength—Bend strengths, preferably determined by two-point loading equipment, will fall off at elevated temperatures. It is essential that the grain size be kept small for maximum strength and that porosity be minimized.

Plastic Deformation—Oxide ceramics can be deformed plastically at an absolute temperature of about half the melting point. This plastic deformation occurs on slip planes in single crystals. In polycrystalline oxide bodies, data suggest that the slight amount of creep results from grain-boundary motions, but this mechanism is not firmly established. Evidence of creep is more pronounced in polycrystalline materials if they belong on crystallographically simple systems.

Ductility—Oxide single crystals can be bent readily by hand if heat-treated. It is presumed that heat-treatment (at 1300C) heals incipient cracks which otherwise would be the starting point for a fracture. No such phenomenon is observed with polycrystalline ceramics.

Impact Strength—The yield stress in ceramics is strongly dependent on the rate of strain. Under conditions of impact loading, yield stress always may exceed brittle-fracture stress, even at temperatures where plastic deformation occurs under slowly applied loads.

Static and Cyclic Fatigue—"Delayed fracture", (static fatigue), is the ultimate failure of a ceramic at a load below which the piece normally will fail at fast-loading rates. The thesis has been developed that delayed fracture results from atmospheric reaction at the tips of incipient cracks. Cyclic fatigue tests have provided scattered values, probably from sensitivity to local imperfections and clamping stresses.

Thermal Shock Fracture—Fracture resistance is enhanced by a high breaking stress, low Poisson's ratio and a high thermal conductivity, which minimizes thermal differentials. Fracture resistance is diminished by a high elastic modulus and thermal expansion. While quantitative and simulative service tests are used extensively, their confidence level is not high and results are often unreliable in predicting performance.

Abstracted from a technical paper, "Ceramic Materials: A Chemical and Structural Description"; ASME No. 61-MD-5; $1; to ASME members, $0.50. The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.



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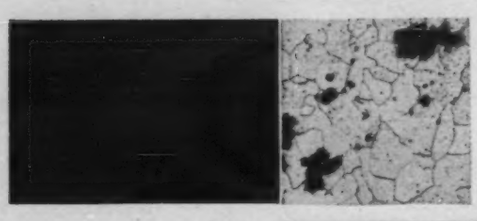
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3-LOBE DESIGN

Exclusive M-D 3-lobe design adds strength—reduces torsion. Dynamically balanced rotor permits higher speeds —greater pressures.

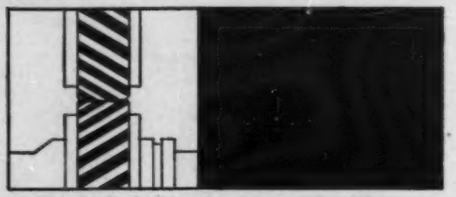


DUCTILE IRON

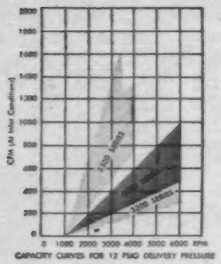
Only M-D uses ductile iron rotors. Only M-D rotors are cast with lobe and shaft integral—no pins to work loose. Makes M-D blowers safest at high speeds.

HELICAL GEARS

Every M-D blower shipped has a matched pair of crown-shaved, helical gears. Backlash tolerance is .0005" to .0015". No other blower matches M-D quality.

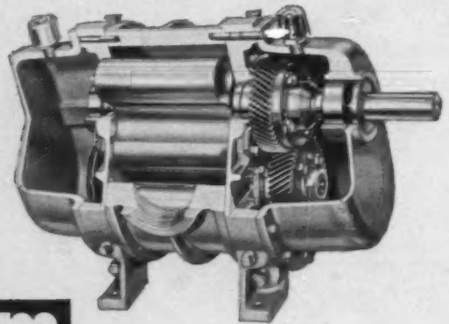


WHY M-D ROTARY POSITIVE BLOWERS DEVELOP HIGHER PRESSURES...



The unique combination of precision manufacture and modern design found only in M-D rotary positive blowers permits higher speed operation and higher pressures. For this reason M-D can furnish greater air flow at lower initial cost.

M-D blowers operate at wider pressure and speed ranges than any other rotary positive blower. Capacities of 30 production models range from 30 to 4,000 CFM, pressures to 15 PSIG single, 70 PSIG multi-stage.



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M-D BLOWERS, INC., RACINE, WISCONSIN

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Design Simplicity And Reliability—What Is It?

L. Bednarchik and J. Cooper,
Northrop Corp., Norair Div., Hawthorne, Calif.

Reliability figures generally are derived from experimental evidence and past experience on component failures. Theoretically components can be built so that the only failure experienced is wearout. Practically, however, this does not happen. Much of the work in future systems will be limited to short production runs, thereby precluding the use of test redesign and rework and consequently demanding a "right the first time" criterion.

To meet this demand requires a complete understanding between the designer and producer. To reach this understanding, it is necessary that both speak the same language.

Isolation of Problem

Norair Quality Control set about to find a systematic solution. Knowing that in any event it was the human who would control production and quality, Human Engineering was asked to participate in helping to determine this solution.

Work packages in various product lines were analyzed carefully to determine the factors contributing to substandard quality performance. This investigation revealed that: (1) format and notation from document to document and blueprint to blueprint varied considerably; (2) it was necessary to use an inordinate amount of written material to produce or inspect materiel, and (3) quite often the written material could not be understood by the personnel who were obliged to use it. Human Engineering undertook to determine what effect these findings would have on the production and quality control of materiel. Based on this information, Quality Control was to provide a solution to the problem.

Human Engineering Considerations

Human Engineering proceeded from the assumption that the role of the human could be considered analogous to an information-processing device in which outputs (behavior) could be directed into desired modes by the proper use of internal processes (psychological variables and conditioning) and stimuli presentation. The conditioning variables were taken as fixed. The study thus would be concerned with the effect of stimuli in the form of information presentations to the human, and how these affect the behavioral responses and are affected by psychological variables.

THE WAY TO CUT EXCESSIVE WEAR



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Iron and steel particles that wear off moving parts and circulate in the lubricant are a primary cause of wear to bearings, bushings, gears, cams, etc.

The powerful magnet in the Lisle Magnetic Plug pulls these particles out of the lubricant — assuring longer, quieter, trouble-free, operation of your product.

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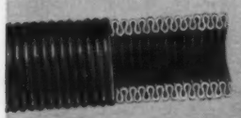
Whether you need steel, bronze or stainless steel to convey air, oil, water, gas, steam, volatiles or light solids, Penflex has the answer. Its complete line of corrugated and interlocked tubing is rugged, safe at high pressures and temperatures. Write for data to Pennsylvania Flexible Metallic Tubing Co., Inc., Route 30, Paoli, Pa.



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Penflex Interlocked Hose



Penflexweld All-Metal Tubing

PENFLEX
TIGHT AS A PIPE BUT...
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Criteria for Written Material

The study established the following criteria for drawings and documents: (1) information must not be excessive; (2) information must be sufficient; (3) information must be consistent and organized; (4) information must be valid and accurate; (5) information must be presented in the user's language; (6) information must be current, available and accessible; (7) information must be self-sufficient, and (8) information must be in such form as to be convenient to handle.

Approach to Problem Solution

Once these criteria have been established, it becomes necessary to provide solutions to the problem in accord with these criteria in addition to procedures for implementing the solutions. Accordingly, Quality Control Engineering established a specialized unit within the Inspection Planning Branch for this translation and implementation. To accomplish this, the Inspection Planning Branch developed a presentation media called the Visual Check List which was implemented in assembly and major assembly areas.

Visual Check List

The Visual Check List is a perspective production drawing which shows only the pertinent information needed to perform a given task. It was impossible to translate the tremendous amount of information which was constituted by all of the drawings. A method was originated by which a group of experienced personnel would go over the engineering drawings and by analysis determine those drawings which would present a problem to the worker. When the analysis reveals an area in which a Visual Check List is necessary, the list is prepared. It consists of an 8½- by 11-inch folder containing the information necessary to perform an operation. The pictorial representation of the area is presented on a single drawing and reproduced on card stock. The folder contains all the information necessary to complete the operation.

Results

At Norair, the Visual Check List has proved to be an extremely effective tool in the manufacturing cycle. It has provided a means for accomplishing: (1) early specification refinement and plans proofing prior to the first article production; (2) positive configuration control; (3) reduced error potential, and (4) time/cost reductions in manufacturing and inspection.

Abstracted from a technical article presented at the 1961 Western Regional Conference on Quality Control, American Society for Quality Control, March 15-17, 1961. Copies of this paper are available from Dr. Harry G. Romig, 351 Alma Real Dr., Pacific Palisades, Calif.

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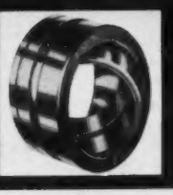
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The New Pathon Series 3H Hydraulic Cylinders are not an adaptation or modification of existing models, but specially designed 3000 P.S.I. Cylinders, continuous service. The 3H Series is available in a wide range of bore sizes and standard mounting types. Like all other Pathon Cylinders, the 3H Series features:

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Illustrated, Model 3H 33 incorporating spherical bearing at the pin connection.

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★ INTERCHANGEABLE with any other rotating union
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DESIGN NEWS
DESIGN IDEAS
CONTROLS

Interlocked Circuits Control Spiraling

E. J. Stefanides, Central States Editor

In a new machine for automatically spiraling and sorting film-type (carbon or metal) resistors, three interlocked electrical circuits control all machine functions.

In operation this machine can spiral up to 60 pieces a minute at an accuracy ranging up to plus or minus ½ percent. Average at 5 spiral turns is 25 pieces per minute with a nonspiraling time of approximately ½ sec per cycle. Accuracy at this rate is 0.5 percent.

The helix is cut by a friction carbide wheel turning at approximately 20,000 rpm. The wheel is attached to a cutter carriage actuated by a pneumatic cylinder. This causes rapid movement along the length of the resistor.

A resistance-bridge control circuit, connected to the resistance being cut through electrically isolated spindles, continuously monitors the workpiece resistance. When desired resistance is attained, the resistance-bridge control circuit lifts the cutter wheel and initiates one cycle of an interlocked cam-switch circuit.

The cam-switch circuit then unloads and reloads the spindles, simultaneously moving the cutter wheel table back to its original starting position. It then completes its cycle by de-energizing the cutter wheel solenoid. Simultaneously it starts the table on its next traverse and resets the resistance-bridge circuit.

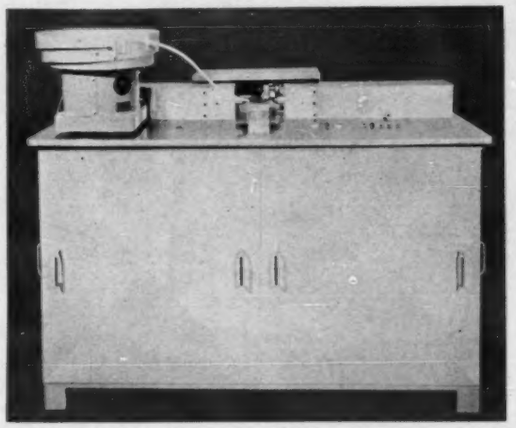
Nonuniformity of the deposited coating may result in some resistors being short spiraled. Resistance is then achieved in too short a length, resulting in too high a watt density. Other resistors may be low valued, the resistance not being achieved in the length available. These reject resistors must be separated from the good; they also must be separated from each other for some processes.

Sorting is accomplished by a three-channel sorting chute, having two solenoid-operated doors for the outer channels and two limit switches which sense cutter table position. When the solenoids are energized, they move the doors across the center channel, diverting the resistor from the center channel to the side channels.

When the minimum acceptable spiral length is reached, one of the limit switches is opened by contact with the cutter table and locks out the short-spiral solenoid. When desired resistance is achieved, the resistance-bridge circuit locks out the other. The good resistor can then fall straight through.

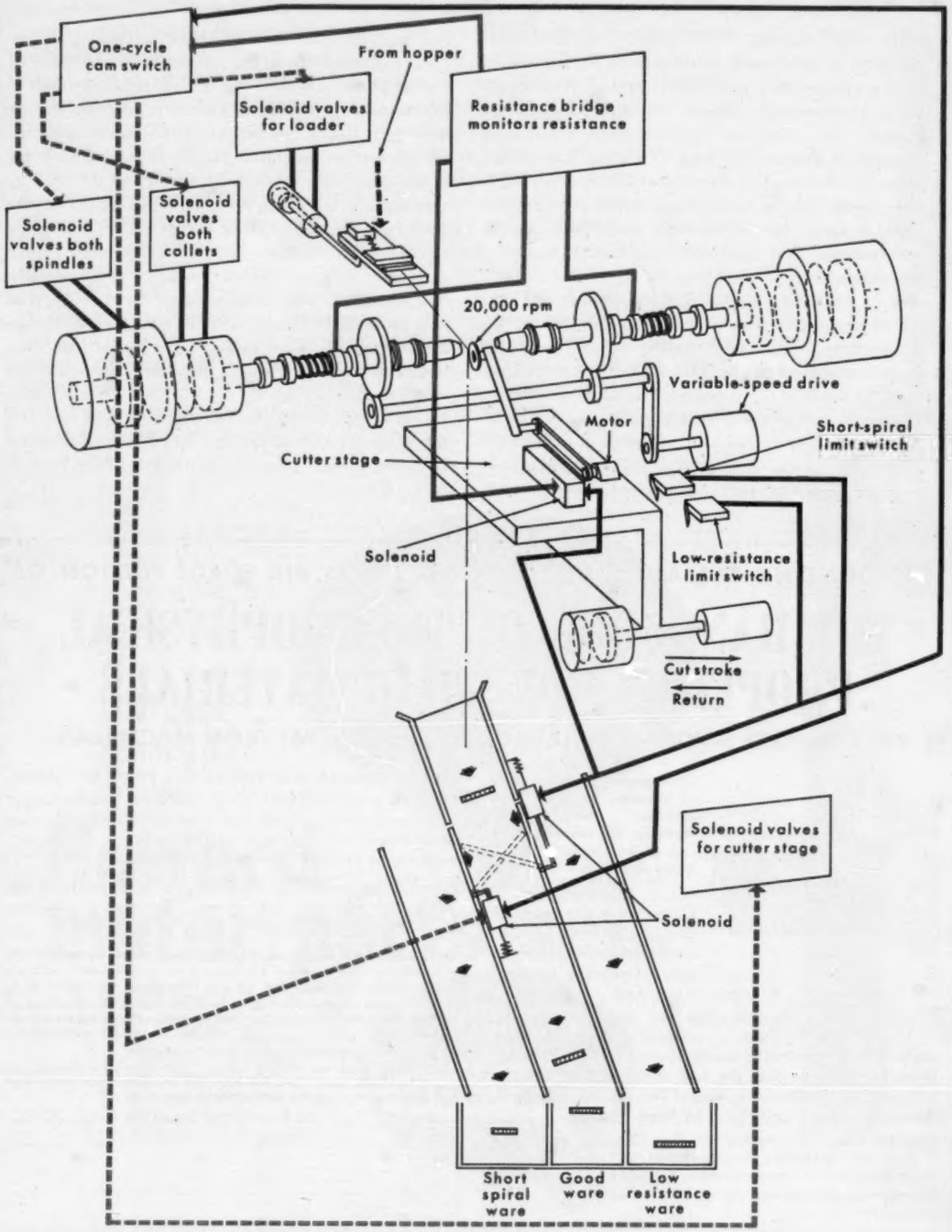
Other features of the machine include a variable-speed drive on the spindle, pneumatic control of cutter traverse and helix angle, and depth adjustments on the cutter. These allow the cycle to be adjusted either for optimum production or optimum power dissipation of the resistor.

This machine is one of a line of special machines designed and manufactured for the automatic production of electronic components by Sigma Engineering Service, Inc., Custer City, Pa.



RESISTOR enters loader via tube from hopper. Solenoid valve pressurizes air cylinder to extend plunger with vacuum grip on end, carrying resistor to spindles. As plunger extends, compression spring moves upper slide a short distance, placing next resistor in position for pickup. Plunger retracts and new resistor drops down to vacuum grip; upper slide then is returned in line with tube by tension spring. Both spindles are actuated by air cylinders for axial movement and collet gripping action; solenoid valves control cylinders. Design permits high contact pressure without axial compressive forces. Synchronized drive of spindles prevents torsional stresses. Spindles are part of resistance-bridge circuit and are isolated electrically from frame. Racks adjust for various length resistors. High-speed, carbide cutting wheel is driven by timing belt from universal-type motor. Wheel arm is spring-loaded and pivots about drive pulley shaft. D-C solenoid, when energized, causes arm to pivot wheel away from resistor; action is rapid and provides best accuracy on resistance tolerance. Adjustment screws provide helix angle setting of cutter head and depth of cut. Air cylinder controls table traverse.

and Sorting of Resistors



push-pull CONTROLS

Compression & Tension Type

Aircraft cable is strung with spherical steel shells in a rigid or flexible housing sealed with "O" rings. 3" standard bend radius. ¾" minimum bend radius.

Three Types:

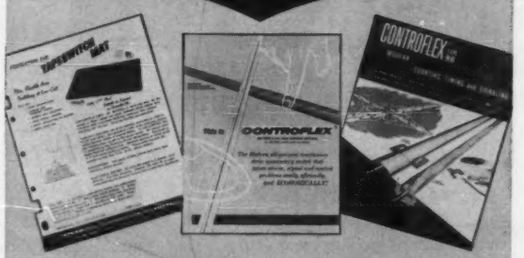
1. *Light Duty*—Compression Ult. Load 1250 lbs.; Ult. tension 960 lbs.
2. *Heavy Duty*—Compression Ult. Load 1650 lbs.; Ult. tension 960 lbs.
3. *Extra Heavy Duty*—Compression Ult. Load 3050 lbs.; Ult. tension 3900 lbs.

Positive remote controls for actuating mechanical, hydraulic or other devices. Eliminate bell cranks, pulleys and dual cables. U. S. Patent No. 2441719. All world rights reserved. Send for ENGINEERING MANUAL No. 1551 giving complete specifications covering materials, finishes, capacities. Please address Dept. DN-61

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To provide spring pins that will not damage, distort or rupture holes even in soft, brittle or thin materials, SPIROL PINS come in MEDIUM and LIGHT DUTY, as well as Heavy Duty for more rugged uses. The entire length of a SPIROL PIN assumes the shape of its hole radially, giving greater shear, shock and vibration resistance. Therefore, MEDIUM and LIGHT DUTY PINS apply where other flexible pins cannot be used.

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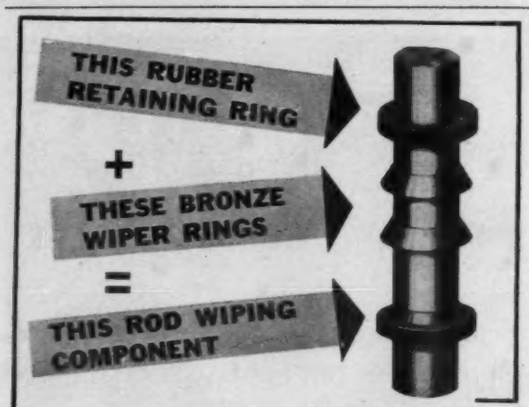


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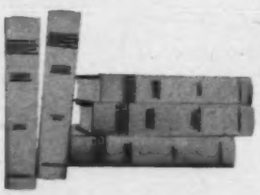
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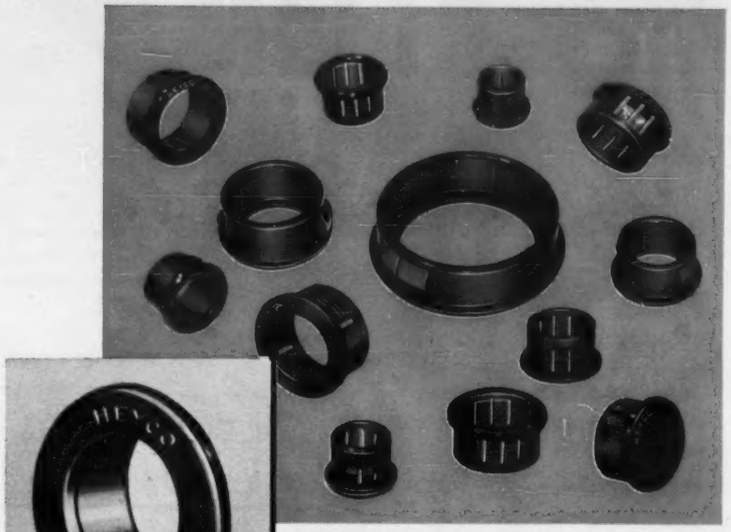
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SCANNING PRESS RELEASES

• **GATLING GUNS,** developed nearly 100 years apart, are contrasted side by side in Civil War Centennial. At left, tripod-mounted Gatling gun of 1861 era that was hand-cranked by a blue-coated infantryman. At right, the Gatling-type Vulcan 20-mm cannon mounted in U. S. Air Force's 1500-mph Lookheed Starfighter (background). The modern version of the revolving barrel gun is powered electrically. Built by General Electric, the Vulcan can unleash 10 times the firepower of a World War II fighter's machine guns. Pressure-suited pilot also is garbed quite differently from his 19th-century predecessor.



• **SPACE VEHICLES** may be propelled on long interplanetary voyages by a new radio-frequency technique described by scientists of the Radio Corp. of America.

The technique employs ultrahigh radio frequencies to accelerate charged particles—electrons and ions—to high velocity.

Basic "fuel" is plasma—a mixture of ions and electrons generated by successive electrical discharges from a pool of mercury and released into a cylindrical chamber. Radio-frequency power is applied to chamber, producing an electrical field that is strongest near plasma source and decreases rapidly with increasing distance along chamber.

Charged particles in plasma are accelerated swiftly from stronger toward weaker field by electrical interaction—somewhat in the manner of balls gathering speed as they roll down a steep grade. The result is a thrust that acts on the chamber and can be used to propel an object in space.

The thrust can be increased by using higher radio frequencies to accelerate a denser plasma. Successful experiments have been performed at frequencies of 140 and 330 mc (millions of cycles per second), and future experiments are planned now at a frequency of 2,500 mc.



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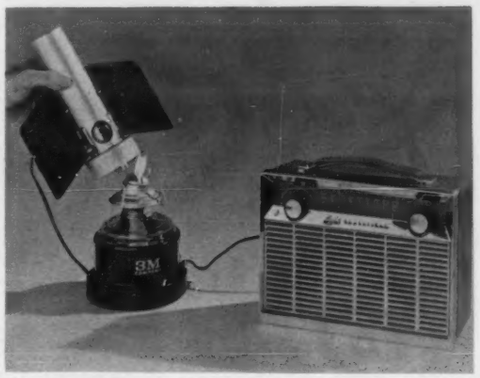


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RELEASES

• **INTERNATIONAL SATELLITE SPACE PROBE SUMMARY,** as issued by the National Aeronautics and Space Administration, Washington, D. C., reports the following space vehicles in orbit as of May 17, 1961:

Name/Country	*Launch Date*	*Transmitting*
Explorer I (US)	1-31-58	No
Vanguard I (US)	3-17-58	Yes
Lunik I (USSR)*	1-2-59	No
Vanguard II (US)	2-17-59	No
Pioneer IV (US)*	3-3-59	No
Explorer VI (US)	8-7-59	No
Vanguard III (US)	9-18-59	No
Explorer VII (US)	10-13-59	Yes
Pioneer V (US)*	3-11-60	No
Tiros I (US)	4-1-60	Yes
Transit I-B (US)	4-13-60	No
Spacecraft I (USSR)	5-15-60	No
Midas II (US)	5-24-60	Yes
Transit II-A (US)	6-22-60	Yes
NRL Satellite (US)	6-22-60	No
Echo I (US)	8-12-60	No
Courier I-B (US)	10-4-60	Yes
Explorer VIII (US)	11-3-60	No
Tiros II (US)	11-23-60	Yes
Samos II (US)	1-31-61	No
Venus probe (USSR)*	2-12-61	No
Explorer IX (US)	2-16-61	No
Discoverer XX (US)	2-17-61	No
Discoverer XXI (US)	2-18-61	No
Explorer X (US)	3-25-61	No
Discoverer XXIII (US)	4-8-61	No
Explorer XI (US)	4-27-61	Yes

*In solar orbit; others in earth orbit.

Current Summary (May 17, 1961)		*Complete Summary* (Launched to date)	
Earth Orbit:	US—22	Earth Orbit:	US—39
	USSR— 1		USSR—*12
Solar Orbit:	US— 2	Solar Orbit:	US—2
	USSR—2		USSR— 2
Transmitting:	US— 8	Lunar Impact:	USSR—1
	USSR— 0		

**Lunik III passed once around moon, then into earth orbit.*

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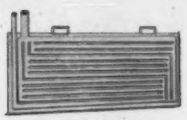
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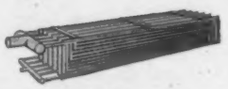
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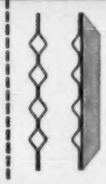


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• **ENRICHED URANIA-BERYLLIA FUEL ELEMENTS** are in the fabrication stage at Coors Porcelain Co. in Golden, Colo. The elements are to be used in Tory II-C, the third in a series of reactors being developed to demonstrate the feasibility of using nuclear energy for ramjet propulsion.

The company, one of the world's acknowledged leaders in industrial and space-age ceramics, will fabricate the fuel elements for Tory II-C in a newly completed, two-story concrete building with 26,000 sq ft of floor area.

The ceramic fuel elements to be made in Golden will not be assembled at the Coors plant.

The finished parts are subjected to stringent physical, chemical and dimensional inspection. They are examined for possible surface flaws by ultraviolet-sensitive dye techniques. Requirements are so severe that every single part must be subjected to X-ray analysis in three different planes for possible interior defects. Finally, the fuel elements are checked for fuel density and fuel distribution.

• **TIN-CAN STEEL STRIPS** will roll at turnpike speeds of more than a mile a minute from a new 32,000-hp mill now being built at United States Steel, Tennessee Coal and Iron Div.'s plant in Fairfield, Ala.

When completed in 1962, the six-stand tandem cold-reduction mill will be the nation's most advanced, according to General Electric engineers who are working with Blaw-Knox Co. of Pittsburgh, the mill builder, to design the equipment.

Advanced features of the new mill's electrical system include extensive use of silicon-controlled rectifiers (SCR's). These semiconductor devices with no moving parts will replace conventional switches and relays in control circuits. They also are being used to convert a-c to d-c for motor field excitation.

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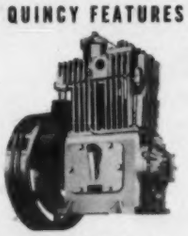
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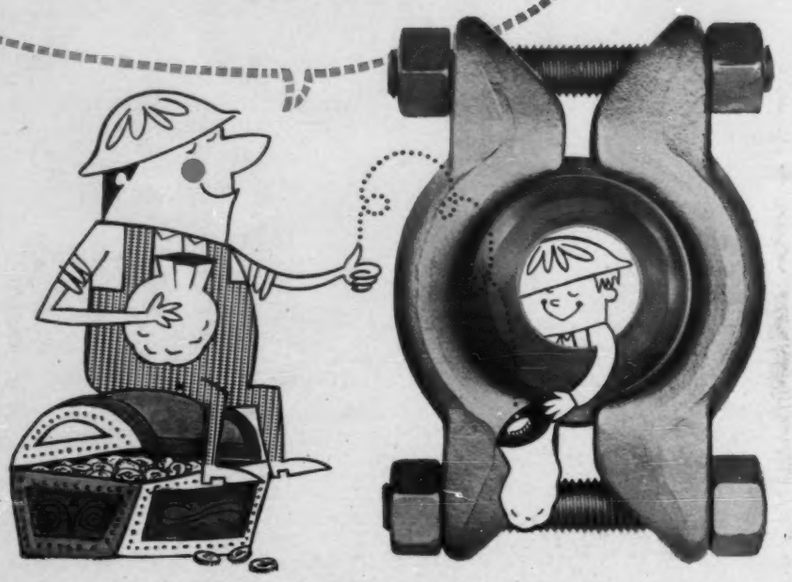


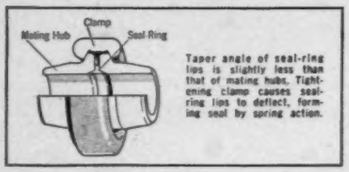
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How Grayloc® Pipe Connections Can Save You Money





Money isn't always measured in dollars — around a shop or plant it may be disguised as space, time, effort, weight, trouble and inventory. With GRAYLOC Pipe Connections, you're saving in all these categories.

Specifically, GRAYLOC Connections are smaller than equally rated flanges so they weigh less. With only two bolts per connection, they take less time, trouble and effort to assemble.

The completely re-usable, all metal seal ring eliminates the need for replacement gaskets, so you save again on inventory and on maintenance time. Fluctuating temperatures and pressures, external stress or vibration never lead to loose, leaky GRAYLOC Connections. After they're assembled, they never need re-tightening.

GRAYLOC Connections are manufactured in standard stock sizes from 1″ to 30″, with special sizes available on request. They can easily be made of corrosion resistant metals on short notice. To learn the complete, validated GRAYLOC story, write today for the GRAYLOC catalog.

GRAYLOC SALES DIVISION

GRAY Tool Company

P. O. BOX 2291 • HOUSTON 1, TEXAS • RIverside 7-1240

6113

Circle 144 on Reader-Service Card for more information

RELEASES

• **UNIQUE SOUNDS FROM OUTER SPACE** have been recorded by General Electric's radio-optical observatory.

A speaker's voice as transmitted to the moon and reflected to earth has been picked up. Signals from several U. S. satellites also have been recorded on the 33⅓-rpm record—PIONEER IV orbiting around the sun, EXPLORER VII's "bagpipe" signals and the faint sound of PIONEER V 815,000 miles from earth.

If you are interested in obtaining a copy of this record, drop a card to J. B. Stroup, Defense Business Information, News Bureau, General Electric Co., Schenectady, N. Y. (gratis, of course).

• **ROBOT CAMERAS** have been installed in one Denver-based patrol car to establish a violator's license-plate number and year, month, date and hour the picture was taken as well as patrol car speed.

Two 35-mm cameras mounted on the right side of the patrol car's dash can be operated by the driver without taking his eyes from the road.

He presses a remote-control button and the cameras—one with standard lens and one with telephoto—record the scene up to five frames a sec each. A special clock-speedometer mounted on the right front fender is included in the photos.

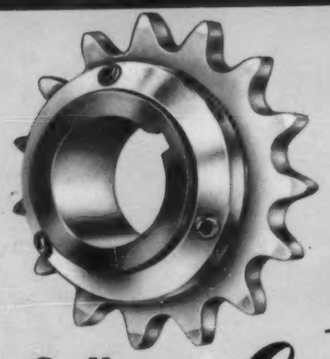
To nail a speeder, for example, the operator presses a button three times at 5 sec intervals. The order in which the photos are taken is shown by the position of the clock's second hand. The violator's speed is determined easily by the size of the car in the various photos compared with the speed shown on the speedometer.

The value of Traffipax (a combination of traffic and pax, Latin for peace) as a psychological deterrent to violators cannot be overlooked.

A powerful electronic flash is included for night work.

Minneapolis-Honeywell, Heiland Div., will market the German-made method of traffic law enforcement.

Circle 145 on Reader-Service Card



all steel= all set to go!

Cullman Grip-Master® Sprockets

Simple, compact, strong... featuring interchangeable sprockets, hubs and bushings—GRIP-MASTER SPROCKETS are ready to use in convenient "off the shelf" sizes and styles . . . the only all-steel constructed sprockets with standard bores, keyways and set screws. Sprockets up to 7" diameter have hardened teeth for longer wear. Easy installation and removal. Better investigate GRIP-MASTER today.

Remember Standard Cullman Sprockets and Roller Chains—also Flexible Couplings . . . always available.

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2618 Carnegie Avenue, Cleveland 15, Ohio
205 North 11th Street, Tampa 2, Florida

WRITE today for free information and literature.

cullman wheel COMPANY

1344 Altgeld Street • Chicago 14, Illinois • BUckingham 1-2800



CORDLESS PATCHBOARDING CUTS COSTS, SIMPLIFIES OPERATIONS, SAVES SPACE, EXTENDS VERSATILITY OF SYSTEMS

As every electronics engineer knows, programming and switching capabilities determine the parameters of a system or a piece of equipment. Until recently, field programming was an expensive, cumbersome and involved affair employing a confusing array of patchcords and plugs. Switching multiple functions in various combinations required expensive, and very limited multi-point switches.

A year ago, the Sealectro Corporation introduced the Sealectoboard. This device, so simple in concept, yet so functional to the design and operation of electronic systems, is now used by manufacturers of a wide range of equipment. Its dependability, versatility and performance has been proved beyond the doubts of the most critical users.

The Sealectoboard offers a degree of versatility beyond that at any other switching device. It permits the interpositioning of components; the switching of functions in parallel or series operations; the interposing of associated circuitry at any point; test equipment analysis of any point in the system.

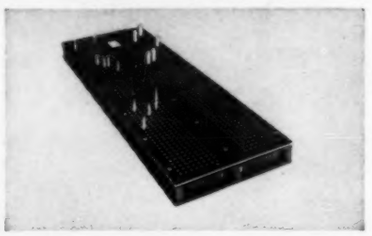
All these functions are carried out in minimum space. Function points are laid out in .250" matrix, providing 16 points in a square inch of panel area.

In operation, any function through the Sealectoboard may be actuated by merely pushing a pin in at the desired X- and Y-axis coordinate point. There is no cord clutter, no polarization dual plugs. The Sealectoboard automatically makes the desired circuit connections upon insertion of the single pin.

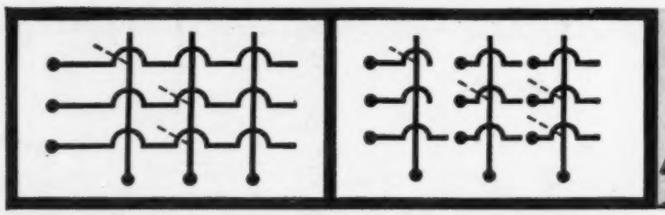
If you use multi-point switching, component interposing, programming in the field, or any of a host of other functions, it will pay you to investigate the Sealectoboard.



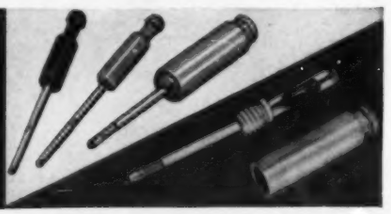
Cross-sectional view of Sealectoboard. Two rows of contacts are run at 90° angles permitting interconnections and interposing associated circuitry at any coordinate. Beryllium copper, silver plated, or gold plated upon special order, provide contacts of low resistance, long life.



Sealectoboards can be made up in any configuration, to best fit the customer's requirements. Panel coding is available according to application needs. Sealectoboard is Patent Pending.



Standard Sealectoboard design incorporates contacts bussed together in each X- and Y-point. Sealectoboards are also available with each contact point on the bottom deck brought out individually for specialized applications. Special designs may be made up bussing pairs, or any specified number of points on the bottom deck. The application possibilities of these various designs are virtually unlimited.



Pins are either of the straight shorting design connecting the two contact decks, or insulated coaxial design which brings both contacts out through the handle of the pin. These are used as component holders, or test lead pins.

PROTO-KIT *Try one and see. An 8 x 9 or 10 x 10 Sealectoboard with shorting pins and component holders permitting you to try and evaluate the versatility of the Sealectoboard. Ask your Sealectro distributor, or order directly . . .* **$19.70 or $28.00 Respectively**

WRITE FOR COMPLETE DETAILS . . .

Sealectro CORPORATION
139 HOYT STREET • MAMARONECK, N. Y.
SEALECTOBOARD

PRESS-FIT® TEFLON TERMINALS
CONHEX® RF CONNECTORS
BRITISH BRANCH: SURREY, ENGLAND

Circle 146 on Reader-Service Card for more information

• **EGGSHELL ARMOR PLATE** from 1/100 to 1/8 inch thick can be used so effectively to protect a space ship from meteoroids that overall weight of the ship's outer walls can be reduced more than 50 percent with no loss of safety, according to a General Electrical space vehicle structures engineer.

Robert R. Wallace, of the company's Missile and Space Vehicle Dept., told American Rocket Society members that "even thinner shields may be optimum" for higher speed meteoroid impacts.

• **DEEP SPACE TELEVISION**, for receiving signals from vehicles probing Mars and beyond, has been described by Sperry Gyroscope engineers as a revolutionary approach to interplanetary communication.

The system can receive television and other broadband telemetered information 400 times faster, more effectively and at one-third the cost of the most advanced methods known today.

Present ground-based antennas are limited to reception of five picture "frames" per minute. The Sperry system can accept, process and present 30 frames per sec, the speed of normal continous motion such as that seen on a home television set.

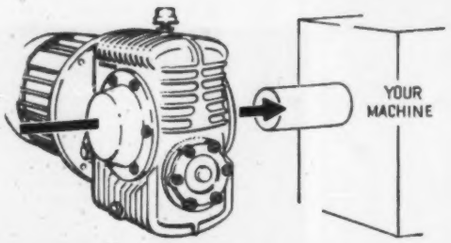
The system offers the way to advances in space communication, navigation and exploration hundreds of millions of miles from earth, thought by scientists to be years away.

The "Automatic Three-Dimensional Electronic Scanned Array" (ATHESA) groups its antennas in a circular pattern and operates them at identical power and frequency to duplicate electronically one giant dish.

Signals from a space-satellite-borne transmitter are received at each antenna in the system and automatically processed through circuits called phase-locked loops to correct for atmospheric and mechanical errors. A reference phase is established for each antenna loop and the phase of each received signal is adjusted to coincide with the reference phase. Signals then are combined in a common receiver. This technique, known as phase coherence, assures maximum detection and amplification of the energy transmitted from space.

The system has been demonstrated successfully in models at Sperry's Great Neck, N. Y., headquarters.

CONE-DRIVE GEARMOTORS for "PLUG-IN" POWER



Hollow-Shaft Speed Reducer-Motor forms complete power transmission package . . .

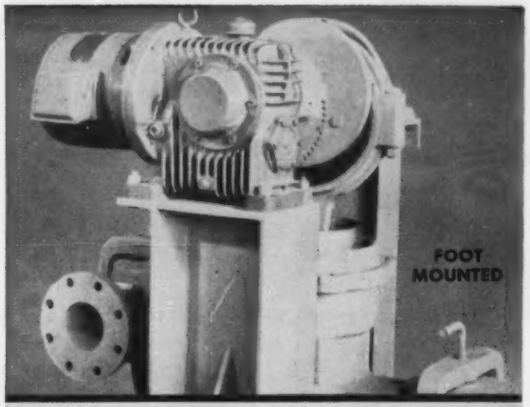
With the compact, right-angle Cone-Drive gearmotor the machine designer can make use of an integral drive package of nearly any required speed and horsepower. Twenty-seven standard output speeds from 7.3 to 525 RPM (with 1750 RPM motor) are available in models from ¼ to 40 horsepower. Gearmotors can be specified with hollow shaft for mounting in any position, ready to "plug-in". You can use this integrated power package to provide a simple, clean installation on your machine . . . no pulleys, belts, sheaves, bed plates, couplings, etc.

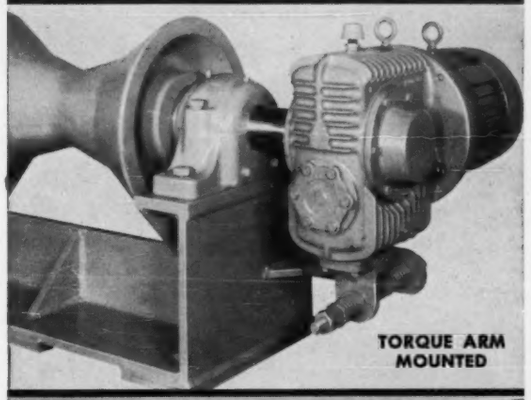
Electric motors are standard "D" flange type with slight shaft modification for driving helical primary reduction gears. Secondary reduction stage is a standard Cone-Drive double-enveloping worm gearset with maximum tooth engagement for greater load carrying capacity in smaller space.

Cone-Drive gearmotors are available for all AGMA service ratings. Call your Cone-Drive representative today or write for catalog #58 for complete specifications.

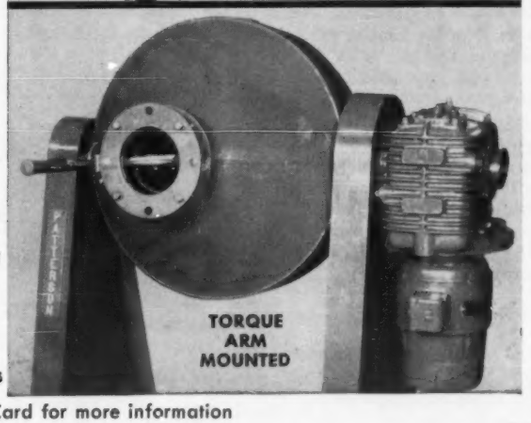
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DIVISION MICHIGAN TOOL COMPANY
7171 E. McNichols Road Detroit 12, Michigan Telephone: TWinbrook 1-3111

DOUBLE-ENVELOPING WORM GEARSETS
DOUBLE-ENVELOPING WORM GEAR SPEED REDUCERS
DOUBLE REDUCTION WORM GEAR SPEED REDUCERS
DOUBLE-ENVELOPING RIGHT ANGLE GEARMOTORS

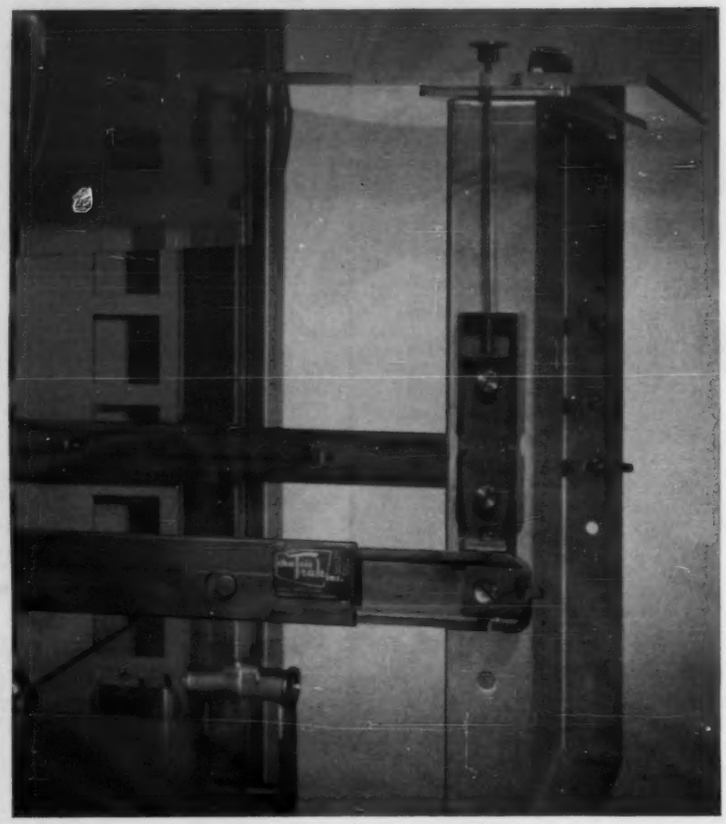








Circle 147 on Reader-Service Card for more information



From CHASSIS-TRAK NEW FEATHER-LIGHT DETENT SLIDE!

Model C-300 Detent locks in three service positions — 90° up, horizontal, 90° down

Chassis-Trak continues to set the pace in slide design with the new Model C-300 Detent. Never before has a tilt-lock slide come in such a small package, yet despite its space-saving size — 1¾" high, ⅜" wide — the Model C-300 Detent will support chassis loads up to 50 lbs. Not the least of the new slide's attractive features is its low price — lowest of any detent slide on the market.

Made of hard, cold-rolled steel, each slide is cadmium plated and then coated with Poxylube 75, a bonded film formulation of molybdenum disulfide, which provides permanent dry lubrication. Solid bearings on all surfaces afford high resistance to shock and vibration.

Model C-300 Detent Slides are available in seven lengths — 12 to 24 in. — and are designed for mounting electronic equipment in any standard rack or cabinet. Like all Chassis-Trak Slides, they are easy to install and smooth and trouble-free in operation.

Model C-300 Detent slide shown locked in horizontal position.



chassis Trak inc.

For further information contact:

525 South Webster, Indianapolis 19, Indiana

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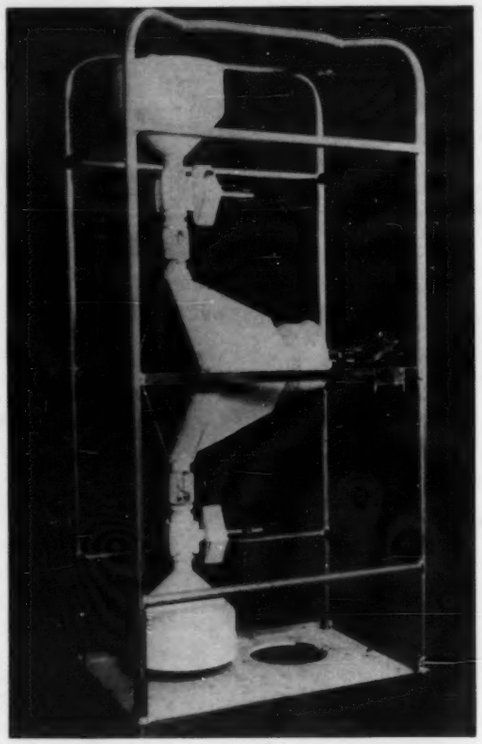
RELEASES

• **MAN'S CONQUEST OF SPACE** is being aided by high-rising plastic balloons which take samples of the atmosphere at 50,000 to 90,000 ft.

The Mechanical Div. of General Mills, Inc., has designed a unique balloon-borne air-sampling device. Key to successful operation is two "Econ-o-miser" ball valves made by the Worcester Valve Co., Inc.

The valves are required to handle three kinds of material or media: air under high vacuum, dry nitrogen and granules.

The complete unit consists of a top and bottom



canister connected through the "Econ-o-miser" ball valves to a filter in the center.

On the ground, the air in both canisters is evacuated by vacuum. Dry nitrogen purges all ground air and the canisters are pressurized at 2 psi. Granules are placed in the top container. Both canisters are sealed tight by the ball valves.

At 30,000-90,000 ft, the ball valve on the top canister is opened automatically by a small electric motor. The granules pass through the filter in the center and are exposed to the atmosphere. The ball valve in the bottom canister opens electrically, the granules flow in and the valve closes, sealing the exposed granules in the canister.

hot cold gas grease grime



scuff shock vibra-tion!

JACOBSEN POWER LAWN TOOLS

. . . whenever any of these punishing conditions challenge the labels and insignia you design, specify rugged "Scotchcal" Film. This tough plastic material has its own tenacious adhesive—specially developed by the world's leading adhesives maker. "Scotchcal" Film goes on dry in seconds—just press in place. Wide choice of vivid colors, metallic finishes. Send for free "Scotchcal" Film Design File and samples today.



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- Trim

SCOTCHCAL® BRAND FILM

MINNESOTA MINING AND MANUFACTURING COMPANY

3M COMPANY

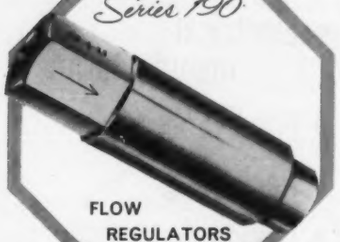
. . . WHERE RESEARCH IS THE KEY TO TOMORROW

ST. PAUL 6, MINN.

Circle 149 on Reader-Service Card

WATERMAN

Series 190



FLOW REGULATORS

Constant Speed Operation

regardless of load!

At a cost comparable to an ordinary restrictor or needle valve, you can have pressure-compensated flow control in your hydraulic circuits.

Rated for pressures to 3000 p.s.i.

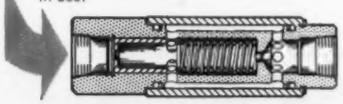
Wide range of sizes available—¼" to 1½" N.P.T.F. and ¼" to 1" S.A.E. tube.

Flows to 100 g.p.m. can be controlled.

Factory-calibrated and tested to ±10% tolerance. Closer tolerance available.

Require little more space than pipe or tube in which installed.

Trouble-free in operation—tens of thousands in use.



Unit senses pressure drop across precise orifice and reacts to control flow with desired limits.

Send today for new Catalog 1002.

NFPA

W-6108

WATERMAN

725 Custer Ave., Evanston, Ill.

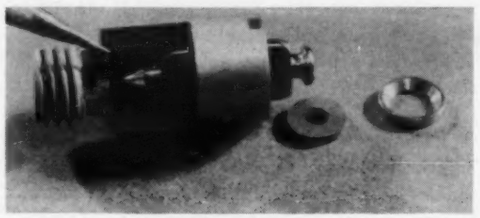
Circle 150 on Reader-Service Card

• **A RESILIENT CARBURETOR NEEDLE** seat that "digests" dirt particles to prevent flooding and to increase fuel economy has been developed by Carter Carburetor Div., ACF Industries, Inc.

The improved needle valve and seat assembly has been added to the carburetor clean-out kits which will be called "Super Zip-Kits".

The resiliency is obtained from a "soft collar" of a newly developed compound set into the especially machined seat at the point of contact with the needle. The collar flexes around dirt particles at the contact while holding the pressure. Cushioning the valve closure also prevents metal-to-metal contact, thereby insuring long life.

The assembly is said to be self-aligning, and the final adjustment is less critical than with all-metal units.



SOFT-COLLAR carburetor needle seat that "digests" dirt particles to prevent flooding and to increase fuel economy is obtained with a newly developed resilient compound which forms the seat at the point of contact with the needle.

• **A NAVIGATION UNIT** that "knows" where it is will be tested by a $1.5 million computer research center, the Sperry Dynamic Simulator. The skeptical computer will be used to probe the mistakes made by the world's "most accurate navigation system" in an attempt to improve its accuracy for future underseas missile launchings.

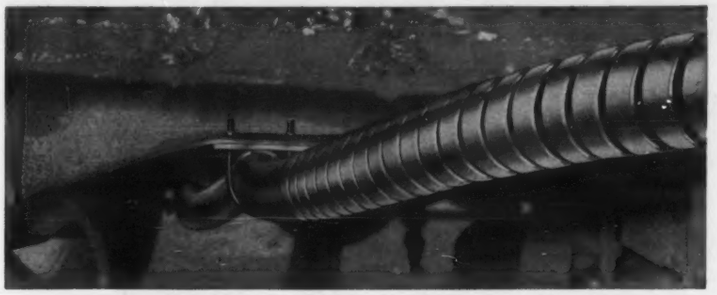
Under examination will be the Polaris submarine navigation system, whose "knowledge" of position and direction is the vital link between the ship and the problem of aiming a 14-ton, nuclear-armed missile from a launching pad.

The computer also will be used to troubleshoot problems growing out of the operation of the navigation system, to test future instruments, such as the Transit satellite system, and to simplify the job of the submarine navigator who is continually faced with the problem of looking for a needle in the world's largest haystack.

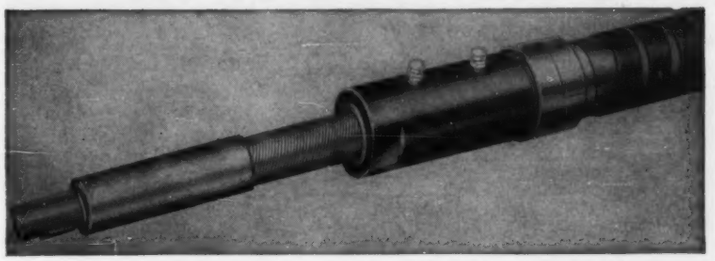
Since the simulator can tackle these problems while the Polaris submarines are at sea, armed and ready, the program can be on the firing line and in the research laboratory at the same time.

Major equipment of the Dynamic Simulator includes the EAI, 231 Analog Computer, the Minneapolis-Honeywell 10 FM Magnetic Tape Recorder and the Elgenco No. 301 Gaussian Noise Generator.

STOW FLEXIBLE SHAFTING
The Ideal PTO Drive



1¼" flexible shaft under tractor-trailer transmitting 10 HP.



1¼" core assembly pulled out of casing. Note steel-backed bronze sleeve bearing.

Here are five big reasons why flexible shafting is an ideal power take-off drive on trucks and tractor trailers.

FLEXIBLE SHAFTING:

1. **Can connect a drive shaft and a driven shaft which are working at different angles and located in different planes.**
2. **Eliminates the need for accurate alignment.**
3. **Eliminates dangerously exposed revolving parts; no safety guards required.**
4. **Replaces connections affected by vibration.**
5. **Is economical because it is so easy to install and maintain.**

Available with built-in bearings and couplings in sizes from ¼ inch to 1¼ inches in diameter—STOW flexible shafting can help solve your trucking and maintenance problems *in advance*. The know-how of 82 years' experience goes into every STOW flexible shaft!

STOW flexible shafts are being used on trucks and tractor-trailers to:

- **Operate pumps for petroleum, other liquids and hydraulic pumps on dump trailers.**
- **Operate conveyors for grain and coal.**
- **Operate compressors on refrigeration trucks.**

Our Engineering Department will be glad to work with you on any special drive problems. For complete data on flexible shafting sizes, torque capacities, and other specifications, write for STOW Engineering Bulletin, No. 570, and Tractor-Trailer Bulletin, No. 542.

STOW

STOW MANUFACTURING CO.

308 Shear St. Binghamton, New York

Circle 151 on Reader-Service Card for more information





PRECISION-MADE SOLDERLESS TERMINALS

Immediate delivery on any type, any size . . . designed to fit most types of crimping tools

The progressive die-stamping pictured above is just one of the up-to-date production techniques that insure the high quality of Hollingsworth terminals. Fashioned from pure copper of the highest grade, all Hollingsworth terminals are meticulously manufactured to provide a completely reliable, vibration-proof connection.

Hollingsworth manufactures 16 types of solderless terminals as standard. They also custom-design solderless terminals for special applications. Whether your terminal requirements are ordinary or extraordinary, Hollingsworth can fill them to your complete satisfaction.

- Full ¼" working shank
- Load capacity greater than that of the wire
- V-type grooves in throat grip wire securely
- Insulated types are color-coded according to size
- Beveled mouth for fast, easy wire insertion

Write for Hollingsworth catalog

HOLLINGSWORTH COMPANY

Solderless Terminal Division

PHOENIXVILLE, PENNSYLVANIA

SA 2189

Circle 152 on Reader-Service Card for more information

RELEASES

• THOUSANDS OF MAN-MADE SAPPHIRES will cover the surface of a communications satellite now being developed by Bell Telephone Laboratories.

The sapphires are expected to protect solar cells from space radiation, enabling "working" telephone satellites to endure the rigors of space for 10 years or more.

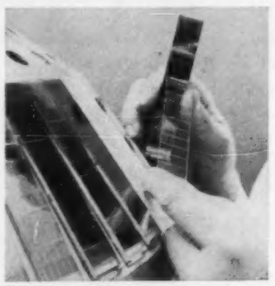
The Bell System previously has announced plans to develop a satellite communications system and put it into operation as soon as possible. A ground station in Maine will be ready early next year. The first satellite will be ready at the same time if the government designates a launching vehicle soon. The Bell System has offered to pay costs of the rocket and launching.

The first experimental phone satellite will be roughly spherical, but may have as many as 60 flat surfaces or gem-like facets. Solar cells on each facet would receive an equal amount of light. The cells—invented at Bell Laboratories—are small silicon wafers mounted on the outside surface to convert sunlight to electricity.

Two different sizes of test satellites—with diameters of 27 inches and 4 ft—are being considered for experiments. More than half of the surface of the smaller one would be covered by over 4000 solar cells; the larger satellite, by 12,000 cells.

Covering the cells will be an equal number of slices of man-made, crystal-clear sapphire. Other protective materials are not being ignored, although sapphire appears most promising.

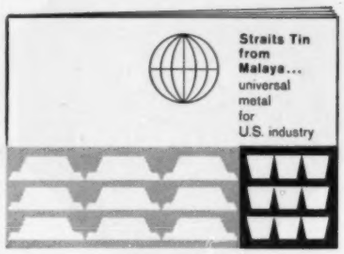
The sapphire does not cost significantly more than other high-quality materials that might be used, and only about one-third of the cost of the solar cells themselves. Sapphire has other advantages. For one, it will convey heat away, preventing the solar cells from being overheated in long periods of continuous sunlight. In addition, sapphire, being hard, will resist corrosion by micrometeorites.



SOLAR CELLS, which convert sunlight into electricity, will be covered by thousands of thin slices of sapphire to protect the solar cells from space radiation. Sapphire slices are set in platinum frames because they have a similar thermal expansion. The protection is expected to enable satellites to keep working for 10 years or more, relaying telephone, data and television across the ocean.

Read this free informative brochure about the latest uses of **tin** in these fields—

- Electronics
- Electrical manufacturing
- Food processing
- Packaging
- Design
- Metalworking



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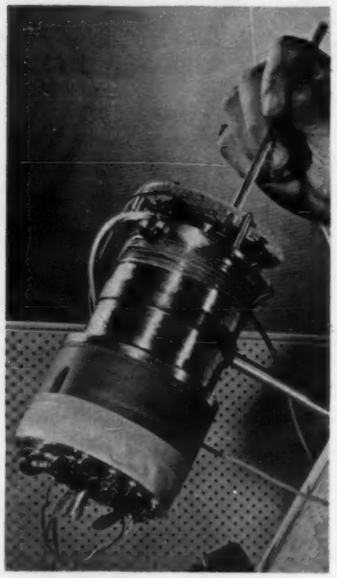
The Malayan Tin Bureau

2000 K St., N.W. Washington 6, D.C.

Circle 153 on Reader-Service Card

• **A SPACE-AGE TIMEPIECE,** the Rubidium Frequency Standard, provides a frequency source stable to one part in 10^{11} over a period of one month—this is comparable to a clock which loses but one sec in 300 years.

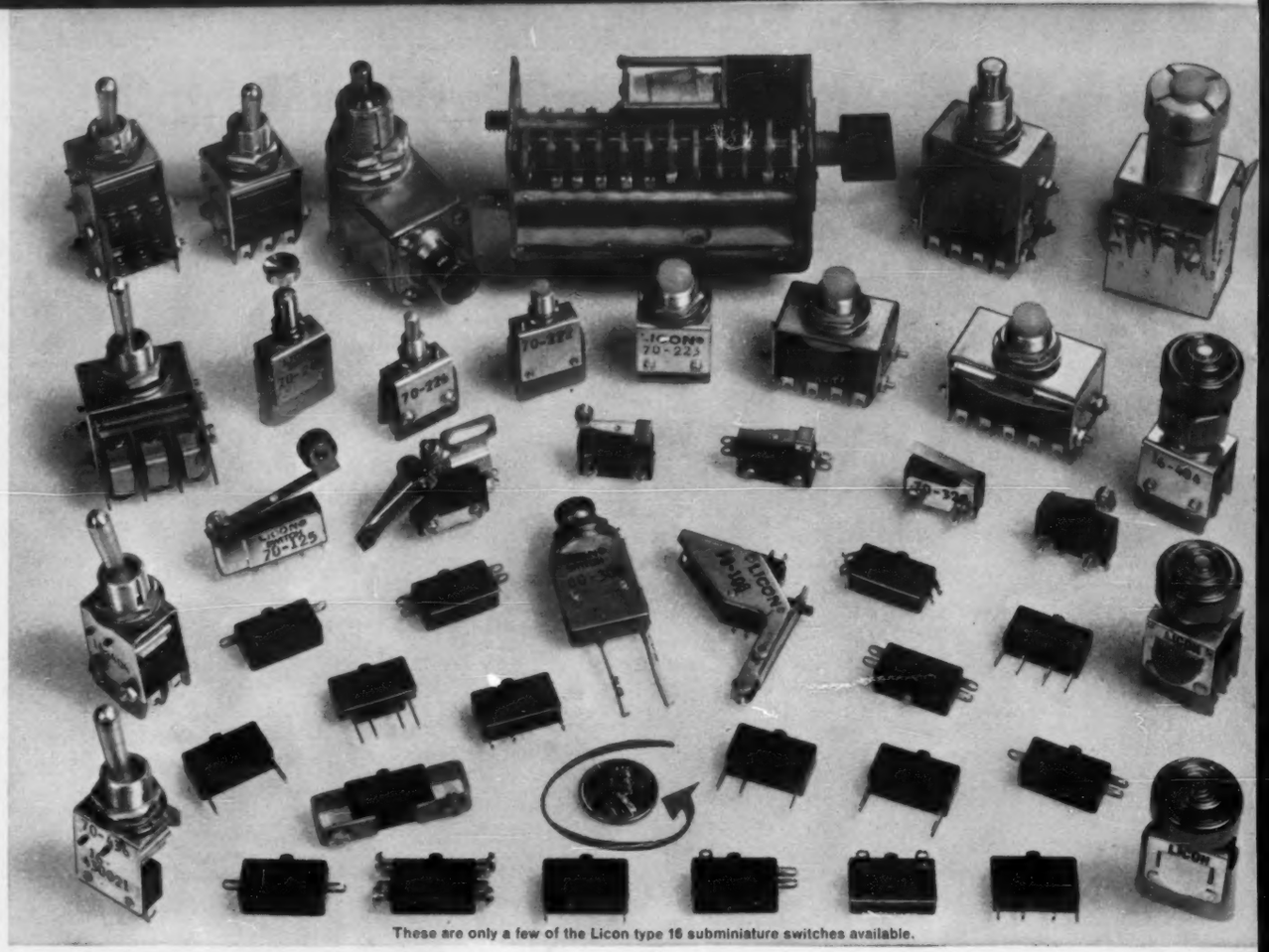
The characteristics of the frequency standard are ideal for many applications in the high-frequency electromagnetic spectrum required in the communications, navigation and computational systems of today's aircraft and missiles.



The "clock"—weighing about 20 lb and approximately the size of a table-model phonograph—will require component replacements as it ages in use; but the rubidium gas cell, the heart of the device, is virtually indestructible.

The Frequency Standard is now being marketed by FMA, Inc., El Segundo, Calif.

Circle 154 on Reader-Service Card



These are only a few of the Licon type 16 subminiature switches available.



LICON®

TYPE 16 SUBMINIATURE SWITCHES

PROVED BETTER 3 WAYS

LONGER LIFE . . . No other subminiature switch can equal the performance and long service life of the Licon Type 16. Only ¼" thick and 25/32" long, the Licon Type 16 delivers over 20,000,000 operational cycles without mechanical failure. This has been repeatedly test-proved. Quality and uniform dependability make the Type 16 superior to *any* subminiature switch.

HIGHEST ELECTRICAL RATING . . . The tiny Type 16 is rated at 10 Amps, 30 volts d-c inductive. This rating, the highest among subminiatures, is achieved with a unique double-break mechanism that effectively increases electrical performance, and life, as well as capacity. Arc energy and heat dissipation are distributed over two places, minimizing the possibility of contact weld. Double-break design offers multiple circuit possibilities not available in other subminiatures. The Licon Type 16 finds wide acceptance in aircraft and missile applications yet is economically adapted to industrial use. Its rating, dependability and performance equal those of a big switch, but its compact size makes it an excellent choice for use where critical space and weight limitations exist.

VERSATILITY . . . Type 16 switches come in reset, momentary, and specially engineered styles. Leaf spring, lever, roller, plunger or combination actuators are standard. Terminals may be solder, screw, or taper tab and may extend from the bottom, sides, or ends of the switch case. Variations of the Type 16 will be engineered to your specification.



THIS CATALOG IS YOURS *on request. It gives dimensional data and engineering "specs" on the Type 16 and the whole broad Licon line. Send for yours today.*

✻ TYPICAL PROVED APPLICATIONS . . .

Licon Type 16 subminiature switches are presently in use in missile detonators, sensing devices on automatic machine tools, automatic postal equipment, speed control devices, communication equipment, coin changer equipment, automatic door openers, relay actuation, and a host of airborne controls, including hermetic and environment-free units.

LICON

Standard Type 16 Switches and Actuators are available through your local Licon distributor.

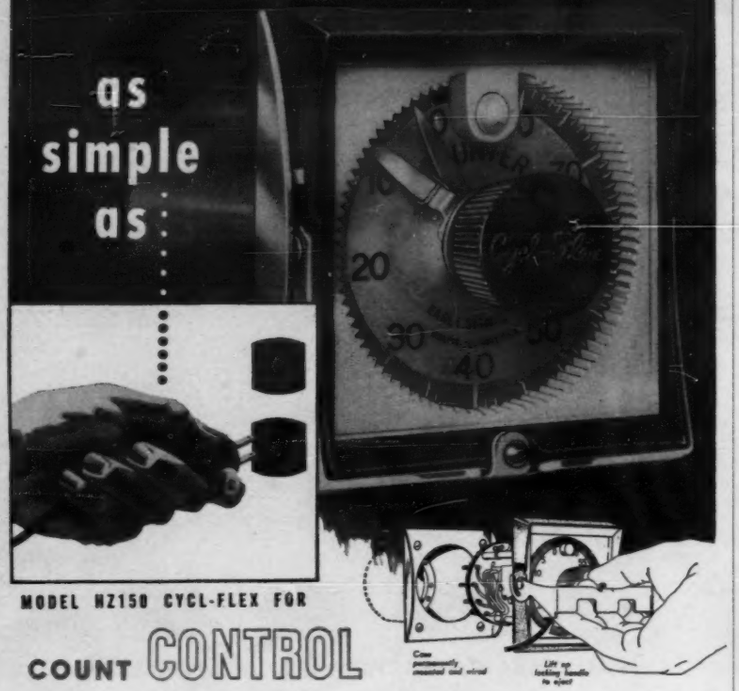
DIVISION OF ILLINOIS TOOL WORKS
6615 W. Irving Park Road, Chicago 34, Illinois

itw

plugging-in EAGLE'S

NEW CYCL-FLEX COUNTER

as simple as



MODEL HZ150 CYCL-FLEX FOR

COUNT CONTROL

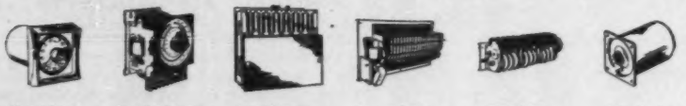
Yes, Eagle's New Cycl-Flex Plug-In Counter is as easy to adapt and change as its companion Cycl-Flex Timer. In fact, in mounting and in over-all appearance, they're exactly the same.

The New Cycl-Flex Counter does more than just count. A large variety of control circuits are yours by utilizing its one instantaneous switch and two delayed switches to control your machines or processes. Use this *count control* to automatically operate:

- The number of molding machine injection strokes
- Number of indexes on a rotary table
- Number of produced pieces before shutting off machine or conveyor

Write for Bulletin 725 or call your local Eagle Representative. He's listed in Sweet's Product Design File, Section 7d, or in Thomas Register.

SPECIFICATIONS • Count Range—80 counts • Electric Reset in ½ second • 400 counts per minute • 3-inch diameter quick setting dial with single knob • Switch rating—10 amps., 115 v., 60 cycle



Plug-in Reset Timers | Precision Interval Timers | Multiple Circuit Timers | Heavy-Duty Step Switches | Multiple Cam Timers | Hermetically Sealed Timers

MANUFACTURERS OF THE MOST COMPLETE LINE OF INDUSTRIAL TIME-COUNT CONTROLS AVAILABLE

EAGLE SIGNAL COMPANY • Moline, Illinois

A DIVISION OF THE GAMEWELL COMPANY, AN E. W. BLISS COMPANY SUBSIDIARY

Circle 155 on Reader-Service Card for more information

RELEASES

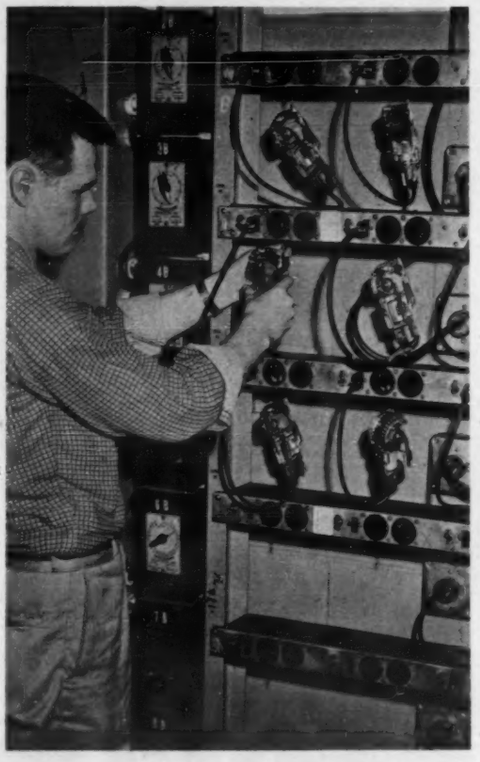
• **CHIRPING OF A THOUSAND CRICKETS,** holding a convention, is a sound that emerges from the 35-acre plant in Northlake, Ill. Its more formal name is the Rotary Stepping Switch Run-In room.

The cricket chatter is caused by the running of hundreds of rotary stepping switches simultaneously.

Each switch is run for at least 100,000 steps. Since the life of a switch is over 200 million steps, the run-in is a negligible part of the switch life.

Every industrial rotary switch built by AE is subjected to this working test for from 30 minutes to eight hours, depending upon the requirements of the particular type of switch.

Running the rotary stepping switches gives the parts a chance to "wear in". Final adjustments then are made without fear that the characteristics of the switch will change after it reaches the customer.



IT'S A FACT

YOU CAN DO BETTER WITH

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PRE-ENGINEERED

BLOWER HOUSINGS

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We have built into our tooling flexibility which enables us to turn out any quantity of housings—large or small—in a broad range of size and styles . . . Available for wheels 3" to 11" diameter in any width—and we assure you prompt delivery! For your special-purpose housings our engineers will tell you how readily adaptations can be made to save you tooling cost.

Our method of manufacture assures low unit cost — inform yourself . . .

FOR MORE FACTS

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Circle 156 on Reader-Service Card

• **TIROS II** completed six months in orbit May 23, 1961, and is continuing to transmit useful data.

The meteorological satellite was launched November 23, 1960, and at that time had an estimated lifetime of about three months during which it was to provide global weather observations via two television cameras and two experimental infrared sensing systems.

As of May 22, 1961, a total of 31,485 photographs had been transmitted by the two television camera systems. Of these, 78 percent of the 9,488 narrow-angle photographs and 76 percent of the 21,997 wide-angle photographs have been classified as fair to good for meteorological analysis.

While both camera systems continue to operate and to perform at least as well as immediately after launch, one infrared system containing five sensors failed on April 23, 1961, after five months of successful operation; the other system has one of its sensors still operating and its other sensor failed only within the last two months. The one remaining sensor that is operating has only limited use.

NASA expects to launch a third TIROS some time this summer. It hopes that the satellite will be operating during the season when hurricanes are likely to occur and when circumstances will be such that TV pictures as well as IR data on at least one of these destructive storms can be obtained. The meteorological data will be furnished to the U. S. Weather Bureau and military services for their use in weather forecasting as well as for research purposes.

Circle 157 on Reader-Service Card

Gold Mine for Cutting Fastening Costs



Size, Type, Metal, Finish . . . We Have Them All

PEM Self-clinching Fasteners are the captive threads for Production Fastening.

They are "installed by a squeeze, one or more at a time, with the greatest of ease" utilizing standard pneumatic or oil-hydraulic squeezers or mechanical presses.

The squeezing action embeds the head projections into the sheet—the displaced metal flowing smoothly and evenly around the back-tapered shank and annular groove to securely lock the fastener into the panel with high torque and push-out resistance.

Used as standard equipment by the leading manufacturers of electronic, electrical and mechanical equipment, they are the solution of many particular engineering and production fastening problems.

Also, the diversification of products permits wide application of the same PEM self-clinching principle—providing one dependable source for all fastener needs.

PEM

PENN ENGINEERING & MANUFACTURING CORP.

DOYLESTOWN • PENNSYLVANIA

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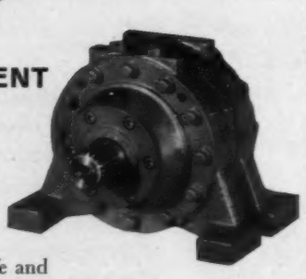
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AND LET HOUDAILLE'S

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CATALOG SHOW YOU THE MOST EFFICIENT WAY TO TURN HYDRAULIC POWER INTO ROTARY ACTION



HydRoAc's high quality means long life and low internal leakage... Expect efficiencies to 95% and over with these compact and powerful high-pressure hydraulic rotary actuators... Unlimited commercial applications range from turret lathes to farm machinery... Instantaneous torque in both directions... Rated operating pressure 3000 p.s.i.... Foot or end mounted... Designing a new product or re-designing an old one... get the Houdaille HydRoAc story first!

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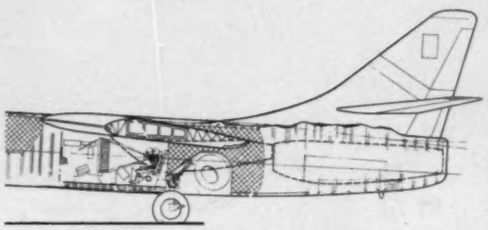
Buffalo Hydraulics Division • Dept. A • 537 E. Delavan Ave., Buffalo 11, N. Y.

Circle 158 on Reader-Service Card for more information

RELEASES

• **DESIGN DETAILS** of the world's first airplane with air-inhaling wings for extended range have been disclosed by the Northrop Corp.





LAMINAR FLOW AIRCRAFT

The performance-stretching "Laminar Flow Control" (LFC) is expected to extend the range, flying endurance or payload of large aircraft 50 percent or more.

The wing will "inhale" air through many fine slots cut in the wing surfaces. This feature will eliminate up to 80 percent of friction drag on the wing without sacrificing structural strength.

The slots are so fine that they cannot be seen from a distance of more than a few feet. Suction turbines inhale air through the slots and exhaust is rearward. This eliminates the air turbulence that causes most of the friction drag.

The new wing will have a span of 93.5 ft, compared with 72.5 ft of the WB-66D weather reconnaissance aircraft. Wing area will be increased from 780 to 1250 sq ft.

General Electric J-79 engines will be substituted for the aircraft's former J-71 powerplants. The engine nacelles will be mounted on the aft fuselage, a design feature of many of the newest transport aircraft including the Sud Caravelle and the Boeing 727.

KENDALL/GOVERNAIRE



SEND FOR CATALOG ON

PRECISION AIR REGULATORS.

Large balanced supply and relief valves provide rapid response with precise control plus maximum flow for minimum size.

Kendall is a direct acting, spring actuated, bleed type valve. Governaire is pilot assisted. Both lines have a unique boost action with increased flow rate that offsets downstream pressure losses. Both are immune to supply pressure variations and suited to either high-flow or dead-end applications. With the Kendall/Governaire lines, Stratos offers the largest selection of standard and special precision pressure regulators, relays and volume boosters in the industry.

For your copy of the Stratos Engineering Manual and Data Sheets illustrated above, write

STRATOS®

A DIVISION OF FAIRCHILD ENGINE & AIRPLANE CORPORATION
Bay Shore, L. I., N. Y.

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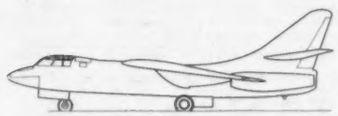
Suction turbines will be mounted beneath the wings where the engine nacelles were located. The pumping system is being developed by the AiResearch Mfg. Div. of Garrett Corp.

Briefly, "Laminar Flow Control" works like this: when an aircraft is in flight, a thin stratum of air, called the boundary layer, flows across the aircraft skin. It flows slower than the surrounding air.

Boundary layer flow is smooth (laminar) at its beginning, but becomes turbulent as it passes along the aircraft skin. Turbulent friction drag is many times larger than the corresponding laminar friction drag. Laminar flow over a large percentage of the wing can be maintained by means of a boundary layer suction through a large number of fine slots. The suction air then is carried through the suction ducts into the suction compressors and then is exhausted in flight direction to obtain additional thrust.



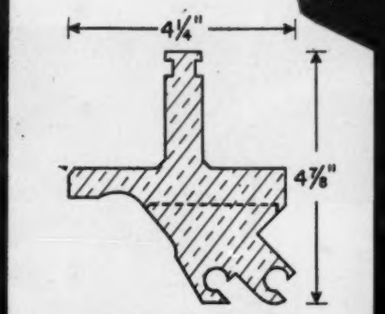




LAMINAR FLOW AIRCRAFT

Circle 160 on Reader-Service Card

AGAIN-



DOTTED LINE SHOWS where two copper extrusions were brazed together to make original part. When you consider the intricate shape and the weight of the part (a 3⅞" section measuring 4¼" x 4⅞", weighing 8 lbs. 7 ozs.), you can readily understand why it was at first thought impractical to make it into a single extrusion.

Revere helps "fit the metal to the job"

AND ONE COPPER EXTRUSION REPLACES TWO, SAVING TIME AND MONEY WITH CONSIDERABLE INCREASE IN LIFE OF PART

The Revere Copper Extrusion shown above was originally two extrusions brazed together. And, since it is quite an intricate shape, and weighty, it was at first thought impractical to make as a single extrusion, but the possibility was believed to be worth investigating.

Through close collaboration between the manufacturer's engineering department and the Revere Methods and Production Departments, it was found possible to combine these two sections into a single extrusion. Work was started, dies were made and test runs conducted. The tooling (for hot extrusion was followed by cold drawing) posed special problems. It had to be both rugged and precise in order to produce this monster to the manufacturer's exacting specifications. Finally, a sample extrusion was delivered to the customer for testing and found to be right in every way.

Not only does this new, single extrusion eliminate a great deal of machining but obviates the necessity of purchasing two separate extrusions and brazing them together. This means substantial savings in dollars and time involved, plus a longer-lasting part, because the heat required to join the two pieces originally used, tended to soften the built-up unit, thus shortening its useful life.

So, before you give up on what at first may seem an insoluble problem, why not call in Revere's Technical Advisory Service? It's entirely possible they can help you "fit the metal to the job" with a resultant saving in the production of a superior product.

REVERE
COPPER AND BRASS INCORPORATED
Founded by Paul Revere in 1801
Executive Offices: 230 Park Ave., New York 17, N.Y.
Mills: Rome, N.Y.; Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles, Riverside and Santa Ana, Calif.; New Bedford and Plymouth, Mass.; Brooklyn, N.Y.; Newport, Ark.; Ft. Calhoun, Neb. Sales Offices in Principal Cities.
Distributors Everywhere

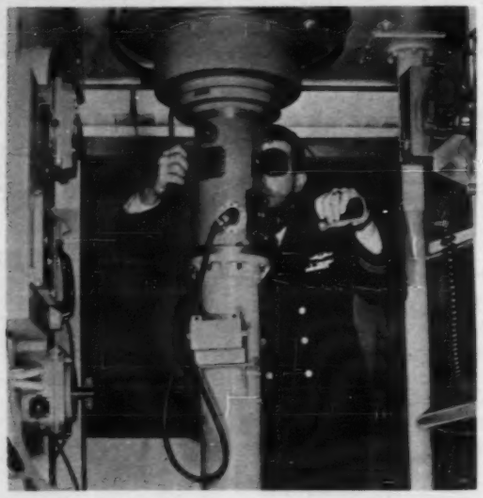
RELEASES

• **BLUEJACKETS** of the U. S. Navy's Polaris missile-firing submarines will exchange places, one going to sea, the other keeping at top efficiency while on shore duty in a huge navigational training system run by electronic computers.

Installed at the U. S. Navy Subschool in New London, Conn., the giant trainer, in conjunction with other systems, is designed to simulate actual Polaris missile-firing missions.

The intricate simulator was developed and built for the Navy by Reflectone Electronics, Inc., of Stamford, Conn., in association with Electric Boat Div. of General Dynamics, under contract with the U. S. Naval Training Device Center, Port Washington, N. Y.

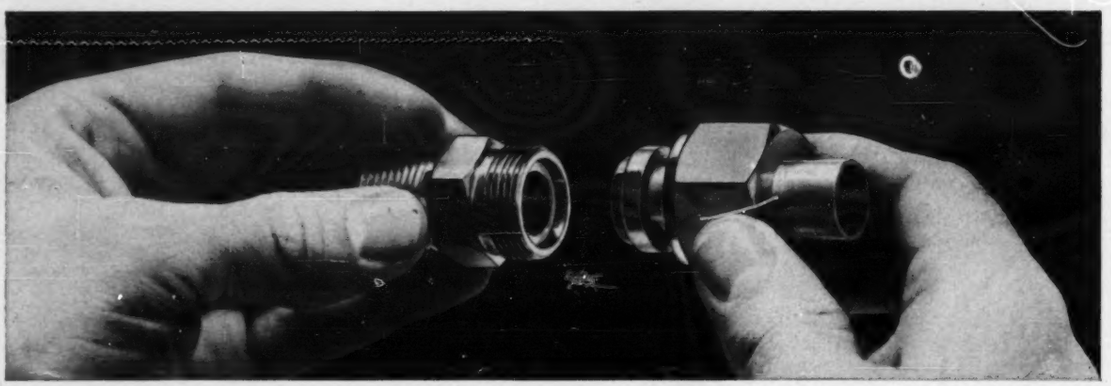
Utilizing electronic computers and an intricate "artificial star sky" the system can look backward or forward in time to produce celestial images for any part of the world at any date in the past, present or future. This capability will enable crews to train under the actual celestial umbrella, amid the known ocean currents they will face when going out to sea several months later.



"TAKING A FIX" during Navigation training at the U. S. Navy Subschool in New London, Conn., a Navy officer is shown preparing to "take a star sight" on Type 8 periscope during operational phase of simulated mission in Reflectone's Navigation Trainer. Giant simulator faithfully duplicates interior of Polaris submarine George Washington.

PROBLEM: absolute reliability of a weldless tube fitting under super pressures, high temperatures, high-frequency vibration or shock

SOLUTION: BRAZE-SEAL



THIS BUTT-JOINT, MAKE-AND-BREAK FITTING WITHSTANDS WORKING PRESSURES UP TO 19,000 P.S.I.*

On many installations where you think only a more costly welded tube fitting can do the job, this Imperial butt-joint BRAZE-SEAL fitting now takes over. It's a compact, economical, simple-to-install fitting withstanding *super* working pressures (see table). It won't yield to high-frequency vibration or shock. With special brazing alloy rings, this fitting withstands temperatures up to 1500° F.

Because Braze-Seal fittings are not welded, you retain the convenience of a make-and-break joint. For more details, call your nearby Imperial-Eastman distributor—or write for Bulletin 3120.

MAXIMUM DESIGN PRESSURES FOR BRAZE-SEAL FITTINGS		
Tube O.D.	P.S.I.—316 Stainless	P.S.I.—Carbon Steel
¼"	77,000	60,000
⅜"	64,000	48,000
½"	62,400	46,800
9/16"	61,600	—
⅝"	61,600	46,200
¾"	60,000	45,000
⅞"	56,000	42,000
1"	52,000	39,000
1¼"	48,000	36,000
1½"	44,000	33,000

*Recommended working pressures allow for 4-to-1 safety factor on sizes up to ¾" O.D., 6-to-1 on sizes ¾" to 1½" O.D.

IMPERIAL EASTMAN

Imperial-Eastman Corporation General Offices: 6300 West Howard Street, Chicago 48, Illinois

Imperial-Eastman Corporation (Canada) Ltd., Barrie, Ontario • Imperial-Eastman, S.A., Apartado Postal 26544, Mexico 13, D.F.

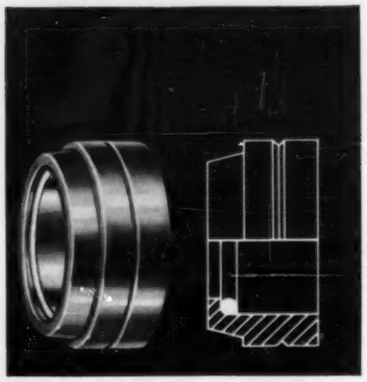
Circle 161 on Reader-Service Card for more information

In the navigation trainer, realistic errors are simulated and inserted into the equipment to provide crew members with actual navigational problems to solve.

The navigation center contains actual equipment, mockups and realistically simulated operational equipments exactly as aboard the sub. These include the Navigation Control Console, SINS (ship's inertial navigation system), NAVDAC (navigational data computer), radio aids, transmitters and receivers, and all other gear. Even air jet controls for de-icing and defogging the periscopes are faithfully reproduced.

When future Polaris subs go to sea, there will be trained "blue" and "gold" crews ready to swing into operation with the equivalent of months of "sea duty" under their belts, experienced on dry land in a giant "simulator".

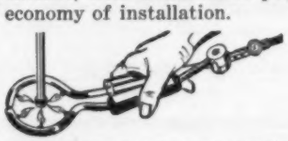
FITTINGS



secret of superiority—
silver alloy brazing ring

Inside the Braze-Seal fitting sleeve is a brazing ring of silver alloy. When the sleeve is slipped over the tube end and heated, the alloy forms a tough, lasting bond between the tube and sleeve. After brazing, the fitting is easily assembled —no special machining necessary, no special tubing required, no flaring, no danger of "over-torquing" the fitting because you can see when it's tight.

Braze-Seal fittings offer other Hi-Seal fitting advantages: make-and-break convenience, close bends made possible, and economy of installation.



6-FLAME TORCH SPEEDS BRAZING
This Braze-Seal acetylene torch simplifies the making of brazed joints. Six-flame jet on circular tip heats sleeve evenly—quickly brazes the silver alloy to form a super-pressure-tight seal.

IMPERIAL — EASTMAN

Meetings

Seattle, Wash. **July 4-7**	ANNUAL MEETING, National Society of Professional Engineers, Olympic Hotel.
Fort Collins, Colo. **July 10-14**	INSTITUTE IN TECHNICAL AND INDUSTRIAL COMMUNICATIONS, Colorado State University.
Portland, Ore. **Aug. 14-17**	NATIONAL WEST COAST MEETING, Society of Automotive Engineers, Sheraton Hotel.
Ann Arbor, Mich. **Aug. 15-17**	CRYOGENIC ENGINEERING CONFERENCE, University of Michigan.
Cambridge, Mass. **Aug. 21-23**	INTERNATIONAL HYPERSONICS CONFERENCE, American Rocket Society, Massachusetts Institute of Technology.
San Francisco, Calif. **Aug. 22-25**	WESTERN ELECTRONICS SHOW AND CONFERENCE, Cow Palace.
Boulder, Colo. **Aug. 28-Sept. 1**	INTERNATIONAL CONFERENCE ON HEAT TRANSFER, American Society of Mechanical Engineers.
Raleigh, N. C. **Sept. 6-8**	JOINT NUCLEAR INSTRUMENTATION SYMPOSIUM, Institute of Radio Engineers, Institute of Electrical Engineers and Instrument Society of America, North Carolina State College.
Los Angeles, Calif. **Sept. 6-8**	ANNUAL MEETING, Association for Computing Machinery, Statler Hilton Hotel.

ROPER PUMPS

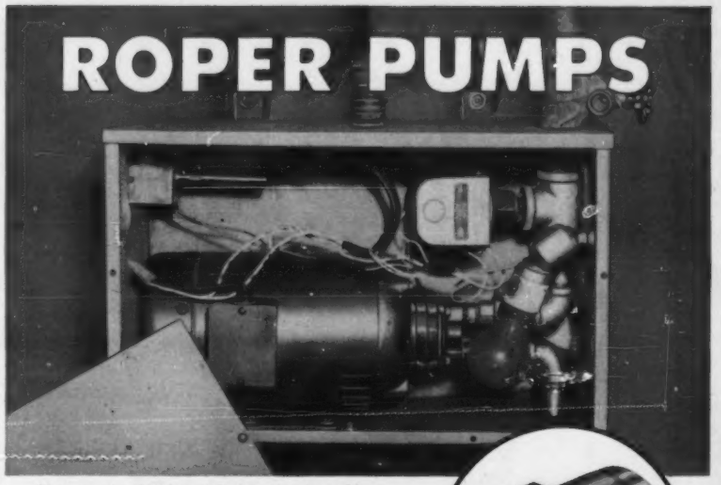
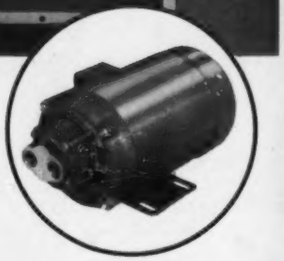


Photo courtesy J-W Materials, Inc., Napoleon, Ohio



SERIES T MODEL 3TL-348

deliver liquid water-reducing admixture for concrete

CAPACITY 0.3-55 GPM • PRESSURES TO 400 PSI

Roper Series T pumps are used exclusively on concrete admixture dispensers Model WR and Model AE manufactured by J-W Materials, Inc. Timer controlled unit delivers measured amounts of liquid concrete admixtures, such as air-entraining and water-reducing agents. The unit handles suction lifts of up to 6′ and transfers material vertically about 50′ at pressures of 25 psi. Flow switch indicates if pump is running dry and by-pass valve permits easy, convenient draining of pump. Dispenser illustrated includes thermo-switch and heat bulb for protection against freezing. There is a choice of many models of the compact, easy-to-install Series T pump for use in hydraulic, pressure feed, and general transfer work pumping clean liquids up to 200 SSU viscosity.

Compact, Rugged, Efficient Qualities

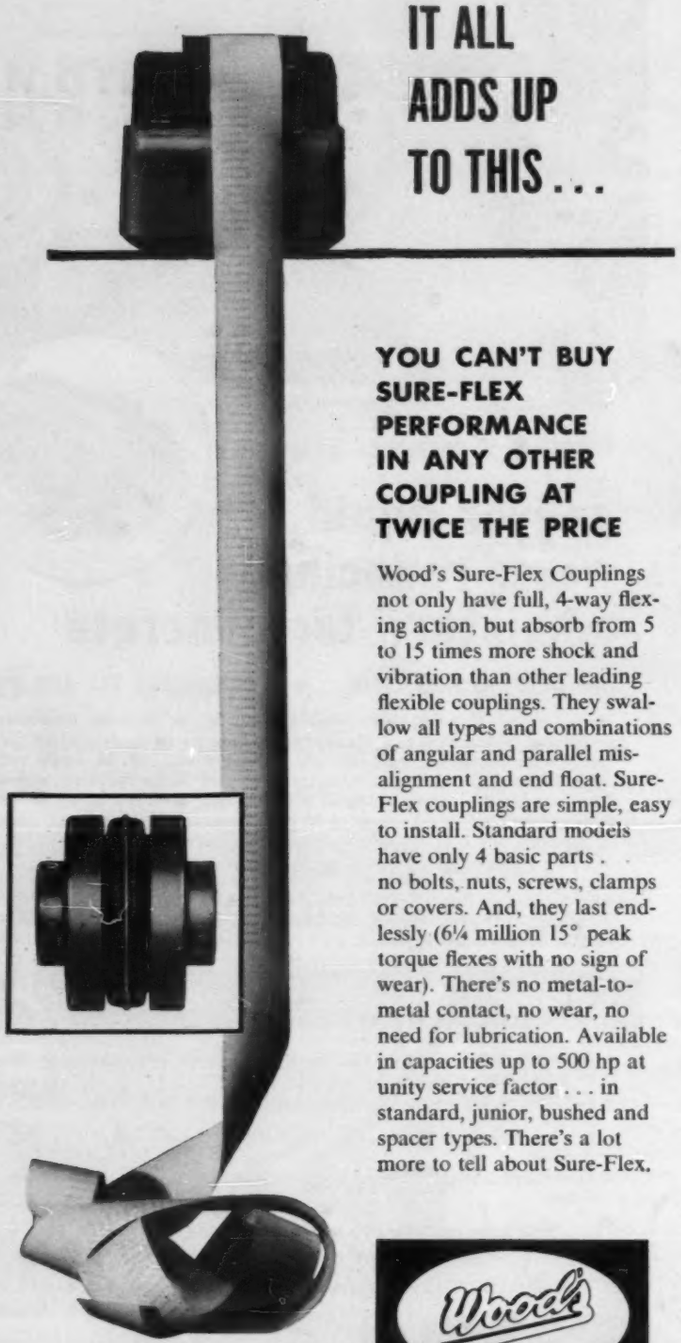
- **PUMPING GEARS** operate in axial hydraulic balance. Driven gear is mounted on motor shaft, eliminating couplings.
- **BEARING** in backplate is heavy-duty bronze; assures proper alignment of driving and pumping gears.
- **SEAL** on drive shaft is either lip or mechanical. Counter-clockwise rotation is standard.
- **BACKPLATE** is single piece, forming end bell of motor, reducing installation space.

For information about your specific pump needs contact your nearest Roper dealer
Send for "How to Solve Pumping Problems" booklet

ROPER HYDRAULICS, INC.

Dependable pumps since 1857
COMMERCE, GEORGIA

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IT ALL ADDS UP TO THIS . . .

YOU CAN'T BUY SURE-FLEX PERFORMANCE IN ANY OTHER COUPLING AT TWICE THE PRICE

Wood's Sure-Flex Couplings not only have full, 4-way flexing action, but absorb from 5 to 15 times more shock and vibration than other leading flexible couplings. They swallow all types and combinations of angular and parallel misalignment and end float. Sure-Flex couplings are simple, easy to install. Standard models have only 4 basic parts . no bolts, nuts, screws, clamps or covers. And, they last endlessly (6¼ million 15° peak torque flexes with no sign of wear). There's no metal-to-metal contact, no wear, no need for lubrication. Available in capacities up to 500 hp at unity service factor . . . in standard, junior, bushed and spacer types. There's a lot more to tell about Sure-Flex.

Write for BULLETIN 5103.

Woods

T. B. WOOD'S SONS COMPANY · CHAMBERSBURG, PENNSYLVANIA

SF/2361 ATLANTA · CAMBRIDGE · CHICAGO · CLEVELAND · DALLAS

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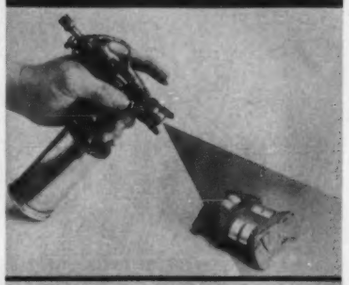
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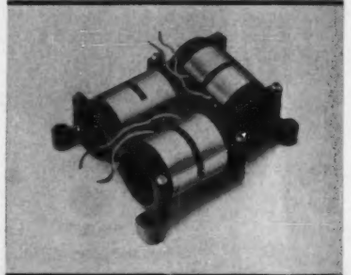
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Electrofilm





SPRAYED-ON HEATING ELEMENTS

Electrofilm's sprayed on — film type heating elements are especially designed for hard to heat contour surfaces. The element can be applied directly to the part . . . or to detachable components.

- **LIGHT WEIGHT** .07 lbs./sq. ft.
- **THIN** .011" to .015" (approx.)
- **ENVIRONMENT** Meets mil E-5272-A Spec.



Write for detailed technical data.

Electrofilm INC.

P.O. BOX 106, NORTH HOLLYWOOD, CALIF.

Circle 164 on Reader-Service Card

Luster-on®

THE FIRST AND FINEST IN CONVERSION COATINGS FOR BRASS, ZINC, CADMIUM, COPPER, ALUMINUM

The Chemical Corporation offers a complete line of uniform-controlled chromate conversion coatings that provide maximum protection in one, low-cost, simple operation. Available for immediate delivery as liquids or powders.

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FOR BRILLIANT CORROSION-RESISTANT FINISHES . . . rivaling chrome for many applications where cost is a factor. Long-lasting, easily controlled application.

FOR CLEAR, BRIGHT and IRIDESCENT COATINGS . . . gives striking, attractive appearance with complete corrosion-protection . . . even when humidity and handling are involved during processing. Also yellow iridescent and olive drab for concealed parts or as a paint bond.

FOR DECORATIVE COLOR . . . on low-cost zinc. Brilliant golds, yellows, blues, greens, violets, reds, brass and copper hues.

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FOR LASTING BRIGHTNESS . . . on both copper and brass without noxious fuming.

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We'd like to show you what Luster-on can offer you! Send in sample part today for free processing. Data sheets on request.

BLAKODIZE* . . . chemical black treatment for steel, provides lustrous, rich, black finish with good degree of penetration and rust resistance.

*T.M. Reg.

The Chemical Corporation

69 Waltham Avenue • Sprinfield, Mass.

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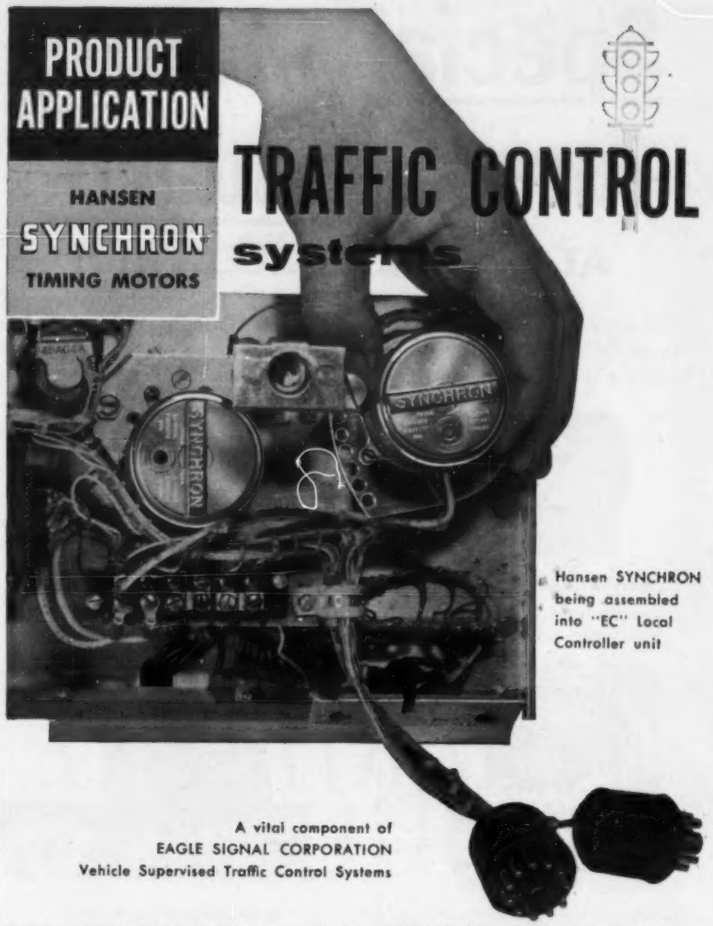
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PRODUCT APPLICATION

HANSEN SYNCHRON TIMING MOTORS

TRAFFIC CONTROL systems



Hansen SYNCHRON being assembled into "EC" Local Controller unit

A vital component of EAGLE SIGNAL CORPORATION Vehicle Supervised Traffic Control Systems

EAGLE SIGNAL CORPORATION uses Hansen SYNCHRON motors for synchronous power to govern signal timing operations in "EC" Traffic Control Systems. Hansen SYNCHRON motors regulate amber and pedestrian clearing intervals — and all other intervals which remain *constant* regardless of cycle length . . . and also govern the 4 independent traffic splits (time division for vehicular traffic) — as well as any interval which is *variable* according to cycle length. The Hansen SYNCHRON, regulating constant intervals, operates on 60-cycle power supply . . . the one governing variable intervals responds to variable frequency from the master control unit.

HANSEN SYNCHRON TIMING MOTORS were chosen by Eagle Signal after careful testing of several makes of synchronous motors. Due to the size of some timing devices and control units, a small motor with good performance characteristics was needed to fit the space limitations. After extensive tests, Hansen SYNCHRON motors were specified for: (1) high-quality performance under test; (2) lower cost; (3) long-life operation as an integral part of traffic control units. Since adoption, Eagle Signal has never experienced an assembly slowdown or stoppage due to failure on service or delivery of Hansen SYNCHRON Timing Motors.

SEND TODAY for informative folder containing specifications and technical data on all Hansen SYNCHRON motors and clock movements.

HANSEN MANUFACTURING COMPANY, INC. PRINCETON, INDIANA

HANSEN REPRESENTATIVES:

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H. C. JOHNSON AGENCIES, INC.
Rochester, N. Y. — Buffalo, N. Y. — Syracuse, N. Y.
Binghamton, N. Y. — Schenectady, N. Y.

ELECTRIC MOTOR ENGINEERING, INC.
Los Angeles, Calif. — (OLive 1-3220)
Oakland, California

WINSLOW ELECTRIC CO.
New York, N.Y. — Essex, Conn. (SOuth 7-8229)
Philadelphia, Penn. Cleveland, Ohio

Sweet's Product Design File

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Special Motors are Standard

AT PEERLESS ELECTRIC!

Need a special motor? Our knowledge may aid in reducing the engineering time. We are the exclusive supplier to many manufacturers for motors with unusual operating conditions and duty requirements. Write us your needs!



DRIP-PROOF (open type)

Completely protected against dripping liquids and falling particles.



DIRECT CURRENT

High starting torque, good overload capacity and high electrical efficiency. For rough usage.

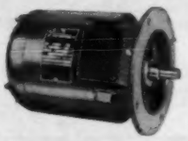


EXPLOSION-PROOF TORQUE MOTOR WITH BRAKE

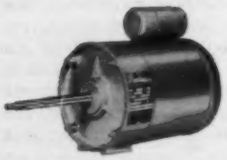


TEPC and EXPLOSION-PROOF

External fan draws cool air across motor toward driven machine.



WEATHER-TIGHT SPECIAL FLANGE



SPECIAL FLANGE REVERSING HOIST MOTOR, SINGLE PHASE

ENGINEERING DATA: Special mountings. Various modifications—special shaft features; paint and varnish treatments, Class A, B, F, H insulation. Peerless builds to standards and specifications of JIC, AIEE (including AIEE No. 45 Marine Duty), ABS, Federal and Military.

WRITE FOR BULLETINS: Space-Saver, SP-1; Torque, T-1; Complete Line, SDA-155. *Peerless Electric Division, H. K. Porter Company, Inc., W. Market Street, Warren, Ohio.*

PEERLESS ELECTRIC DIVISION

PORTER

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PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

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PLANS AND CROSS-SECTIONS

Washing Wool on the Hoof



Some of them were not 'Sanforized'

A process for treating wool still growing on the hoof was invented by an Australian, Roland J. Fitzgerald of Sydney. The gentleman has received a patent for a solution containing soap, sodium or potassium silicate and water that removes excess wool waxes, dirt and unpleasant odors from the growing wool. The sheep is bathed in the solution, which forms a coating on the wool. During the next rainfall or bath, the water-soluble coating then carries away dirty material from the sheep.

This Problem Was a 'Stumper'

The idea of washing wool on the hoof is similar in theory to a method developed by a Russian scientist for curing wood on the stump. The result of 10 years' research, the method treats trees so that they can be preserved, tinted, air-dried, and made fire-resistant and pliable.

The four-stage treatment outlined by P. S. Zakharov causes wood dried while still standing to lose about half its weight, with no warping or cracking.

The tree is first girdled (a ring of bark is removed from its base) and canals are drilled along the girdle. A network of glass or metal tubes is inserted and chemical solutions introduced into the tubes from a bag hung on the tree. Finally, the tree and its canals stay on the stump for a period of time with or without treatment.

Wood dries in three to four summer months, compared to about a year for felled logs.



He's saving up his 10-minue coffee breaks for a three-day weekend.

Computer Quoteth the 'Bard'



It seems to have the idea, anyway....

Shakespeare's words have been spoken by a computer. The machine also sang a song.

The synthetic speech was produced by instructing the computer to change the symbols for sounds, corresponding to the quotation from Shakespeare, into the audible sounds of speech.

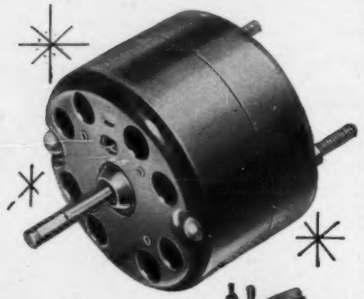
The "talking" computer will say only what it is instructed to say by means of punched cards. The recitation and music heard were taped at the Bell Telephone Lab.

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SMOOTH POWER

AC MOTORS

pack more power into
less space-give dependable
trouble-free service!

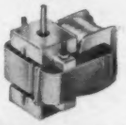


Standard Line AC Induction Motors from 1/1800 to 1/35 H.P.









In any industry, extra care in manufacturing means an extra margin of dependability. Nowhere else is this "extra" so important as in the manufacture of motors — for a product is only as good as the motor that powers it.

General Industries' complete manufacturing facilities mean economy, too as well as on-time delivery. For any fractional h.p. requirement you'll always be right when you specify G.I.

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Quantity Price Quotation On Request

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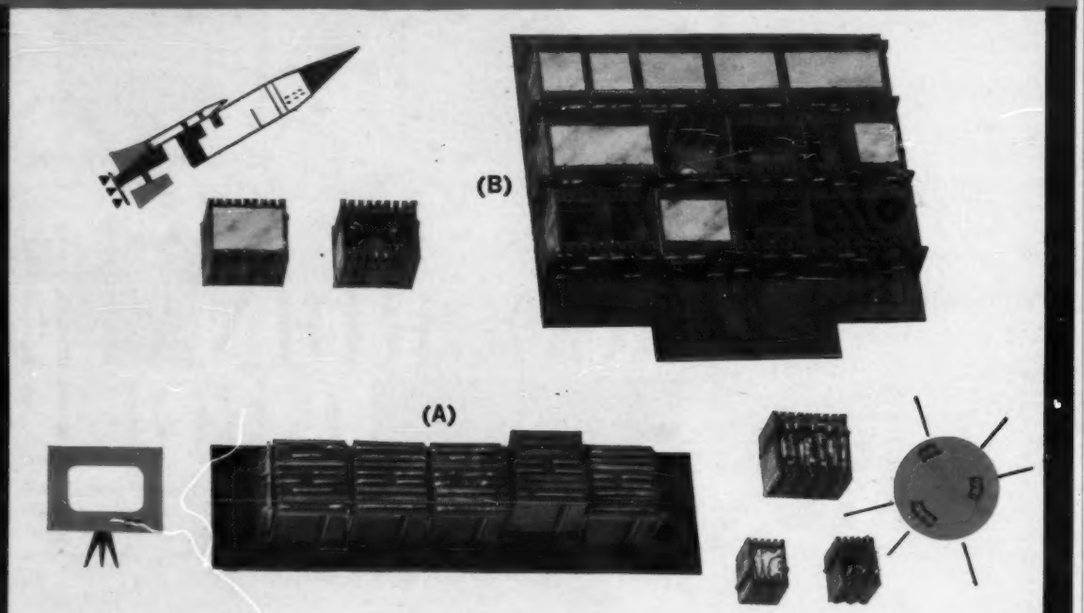
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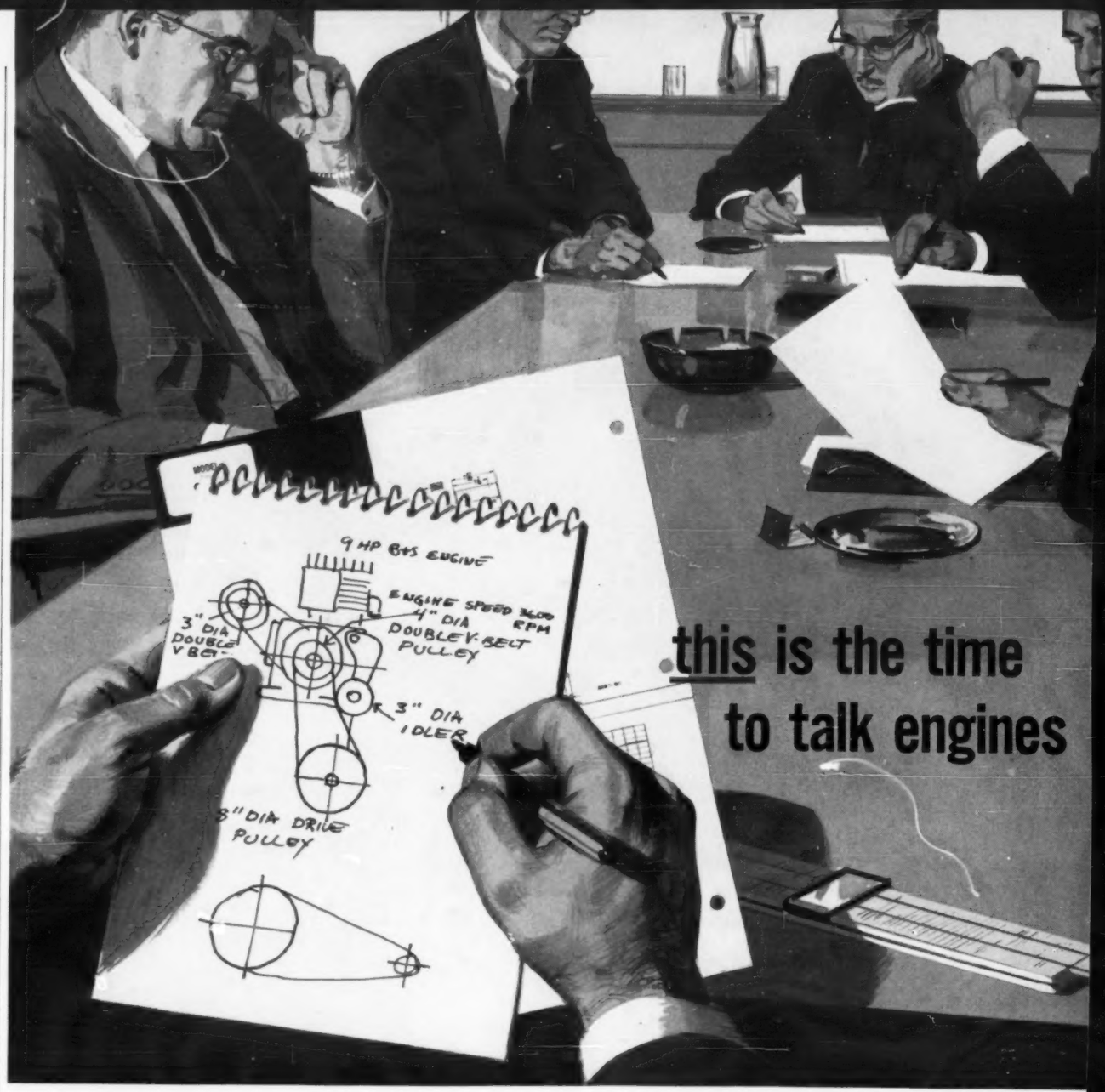
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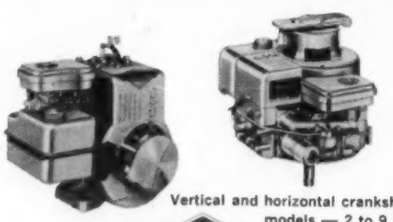
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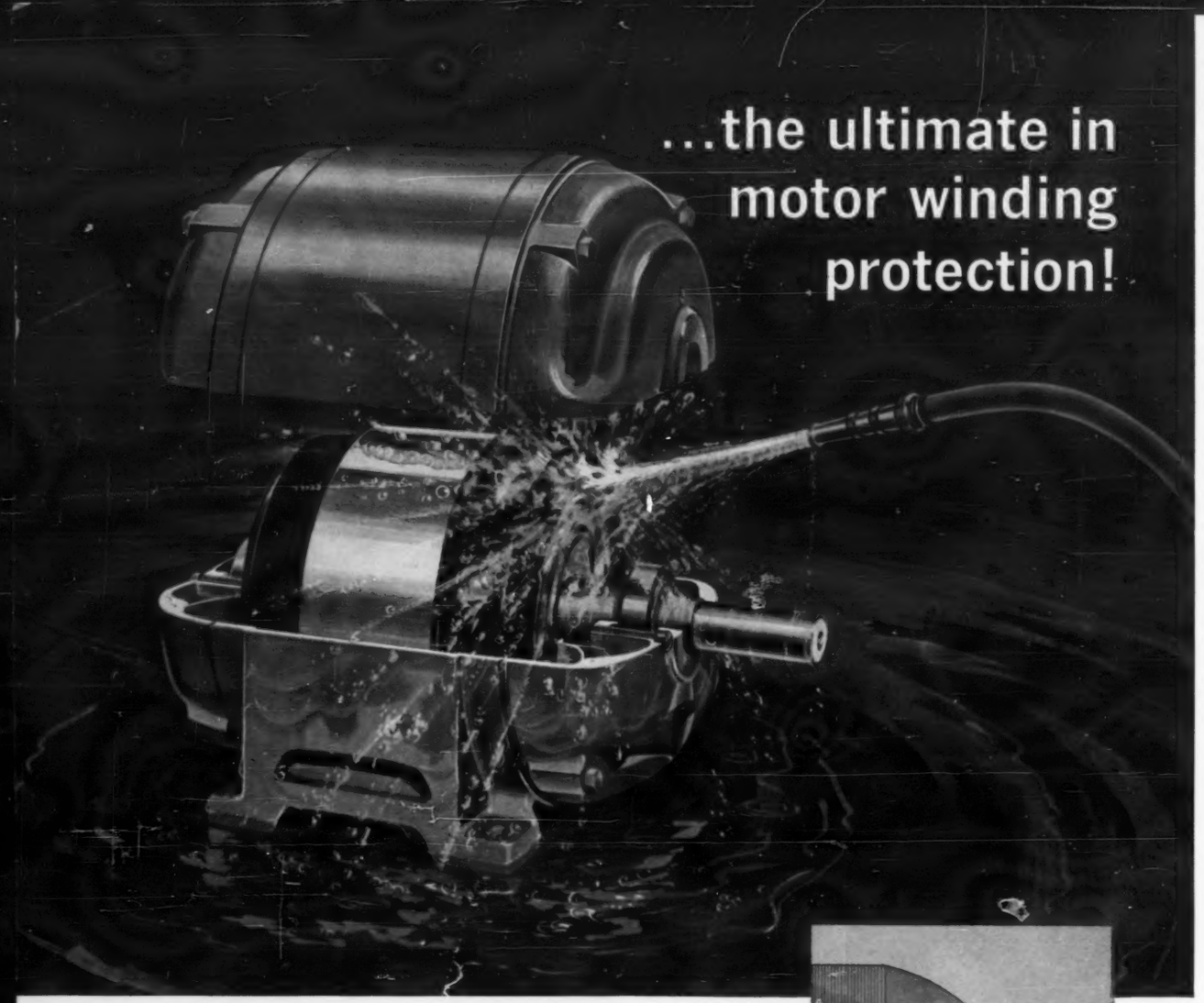
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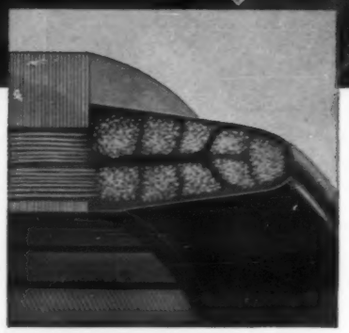


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